GARRETT

SERVICE MANUAL

REPORT NO. 72-02-04
MODEL NO. TFE731-2-1C

A GARRETT TECHNICAL PUBLICATION

AiResearch
Phoenix

THE ATTACHED SERVICE MANUAL
REPORT NO. 72-02-04 IS ISSUED FOR USE
IN SUPPORT OF THE FOLLOWING AIRCRAFT

ENGINE PART NO.	ENGINE MODEL NO.	AIRCRAFT APPLICATION
3070000-1/-2/-3/-4/-5/ -6/-7/-8/-9/-10/-11/ -12/-13	TFE731-2-1C	Falcon 10

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SERVICE MANUAL

TURBOFAN AIRCRAFT ENGINE

PART NO.	MODEL NO.
3070000-1-2/-3/-4/ -5/-6/-7/-8/-9/-10/ -11/-12/-13	TFE731-2-1C

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REPORT NO. 72-02-04
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SERVICE MANUAL
TFE731-2-1C

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SERVICE BULLETIN LIST

Service Bulletin	Incorp.	Title
TFE-GSE SB 1, Rev 1	No Effect	TFE731 SHAFT STRETCHING FIXTURES - Rework Shaft Stretching Fixtures to Provide Improved Relief Valve Operation and More Accurate Pressure Gage
289900 SB No. 1, Rev 1	No Effect	TFE TESTER ASSEMBLY - Modify TFE Trouble Shooting Tester Assembly to be Compatible with Fuel Control Part No. 3070800-7
291262 SB No. 1	No Effect	TFE731 REAR BEARING PULLER ASSEMBLY - Rework Puller Part No. 291262-1 to Part No. 293711-1 to be Compatible with Turbine Bearing Part No. 358750-2
293187 SB No. 1	No Effect	TFE - COMPUTER TESTER ASSEMBLY - Modify Computer Tester to Provide Overspeed Simulation Capability
72-3001, Rev 8	No Effect	ENGINE - SERVICE LIFE - Service Life Limits of Critical Life Limited Components
72-3007	No Effect	ENGINE - POWER SECTION - Replacement of Collars and Retainer of Fan Shaft Assembly and Ring Gear
72-3011, Rev 3	No Effect	ENGINE - TURBOFAN AIRCRAFT - Adapt TFE731-2 Engine to Either Falcon 10 or Learjet Model 35 and 36 Application
72-3013, Rev 1	No Effect	ENGINE - WIRING HARNESS - Installation of Shielded Engine Wiring Harness
72-3016	No Effect	ENGINE - BY-PASS FAN REDUCTION GEAR SECTION - Remove and Replace Pinion Gear Assembly
72-3019, Rev 1	No Effect	ENGINE - ACCESSORY DRIVES - Inspection of Transfer Gearbox Bearing Support
72-3020, Rev 3	No Effect	ENGINE - ACCESSORY DRIVE - Remove and Replace Transfer Gearbox Bearing Support
72-3021, Rev 2	No Effect	ENGINE COMBUSTION SECTION - Replace Combustion Liner with Liner of Improved Design
72-3022, Rev 1	No Effect	ENGINE - COMPRESSOR SECTION - Installation of Compressor with Increased Low Cycle Fatigue Life

SERVICE BULLETIN LIST (CONT)

Service Bulletin	Incorp.	Title
72-3024	No Effect	ENGINE - TRANSFER SHAFT - Remove and Replace Internal Retaining Ring for Transfer Gearbox
72-3025	No Effect	ENGINE - BY-PASS SECTION - Replace Fan Spinner Support Bolts
72-3026, Rev 6	No Effect	ENGINE - TURBINE SECTION - Replace High Pressure Turbine Blades with Blades of Improved Design
72-3033, Rev 1	No Effect	ENGINE - TURBINE SECTION - Replace Low Pressure Turbine Bearing
72-3034, Rev 6	No Effect	ENGINE - OIL COOLER INSTALLATION - Replace Bypass Duct Panel on Engines Incorporating Thrust Reverser Manufactured by Grumman Aerospace Corporation
72-3035, Rev 3	No Effect	ENGINE - DUCT - Thrust Reverser Installation (Manufactured by Grumman Aero-space Corporation)
72-3037, Rev 3	No Effect	ENGINE - TURBOFAN AIRCRAFT - Define Engine Configuration Requirements to Meet Aircraft-Engine System Functional Objectives
72-3038, Rev 2	No Effect	ENGINE - MOUNT INSTALLATION - Replace Engine Mount Bolts
72-3039, Rev 2	No Effect	ENGINE - SUPPORT HOUSING AND INTERMEDIATE CASE - Replace Borescope Inspection Plug
72-3040, Rev 1	No Effect	ENGINE - FAN DUCT - Installation of Fan Duct Set (Split Fan Duct)
72-3041, Rev 1	No Effect	ENGINE - PANEL INSTALLATION - Replace Igniter Access Door Part No. 3071837-2
72-3042, Rev 4	No Effect	ENGINE - COMBUSTION CHAMBER ASSEMBLY - Replace Combustion Liner Part No. 3072448-4 with Improved Combustion Liner Part No. 3072674-1
72-3044	No Effect	ENGINE - ENGINE WIRING HARNESS - Add Jumper Assembly to Improve EMI Capabilities in Electrical System

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72-3046	No Effect	ENGINE - ENGINE SUPPORT HOUSING ASSEMBLY - Rework Engine Support Housing Assembly to Accept Fan Duct Set Part No. 3072420-3
72-3051	No Effect	ENGINE - ENGINE AND COMPUTER WIRING HARNESS - Incorporate New Wiring Harness to Achieve Improved Flight Descent Schedule
72-3053, Rev 1	No Effect	ENGINE - LOW PRESSURE TURBINE ROTOR ASSEMBLY - Install Improved Third Stage LP Turbine Blade Part No. 3072014-2
72-3054, Rev 2	No Effect	ENGINE - PLANET GEAR ASSEMBLY - Install Planet Bearing Part No. 3072775-1 or -2
72-3057, Rev 2	No Effect	ENGINE - LOW PRESSURE TURBINE ASSEMBLY - Install Improved Low Pressure Turbine Rotating Seal
72-3058	No Effect	ENGINE - PLANET GEAR ASSEMBLY - Install Planet Bearing Part No. 358733-4
72-3060, Rev 3	No Effect	ENGINE - HIGH PRESSURE IMPELLER - Install HP Impeller Part No. 3072639-1
72-3063, Rev 1	No Effect	ENGINE - LOW PRESSURE TURBINE ROTOR ASSEMBLY - Install Improved Second Stage LP Turbine Blade Part No. 3072012-2
72-3064, Rev 1	No Effect	ENGINE - BY-PASS FAN REDUCTION GEAR SECTION - Install Retaining (Damper) Ring on Pinion Gear Assembly
72-3065, Rev 2	No Effect	ENGINE - LOW PRESSURE TURBINE ROTOR ASSEMBLY - Install Improved First Stage LP Turbine Blade
72-3067, Rev 1	No Effect	ENGINE - BY-PASS FAN SUPPORT - Install Seal Carrier Bolts Part No. 145-131-9007
72-3070	No Effect	ENGINE - BY-PASS SECTION - Rework Fan Duct Set (Matched) to Increase Interchangeability
72-3076, Rev 1	No Effect	ENGINE - FAN SUPPORT SHAFT AND HOUSING ASSEMBLY - Rework or Replace Fan Drive Shaft Assembly
72-3077, Rev 1	No Effect	ENGINE - PINION GEAR ASSEMBLY - Replace Bolts Attaching Retainer Plate Part No. 3072379-1 to Pinion Gear Assembly

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72-3078	No Effect	ENGINE - POWER SECTION - Install New Bolts with Lockwire Feature that Attach Transfer Tubes to Intermediate Case
72-3080	No Effect	ENGINE - FAN SUPPORT SHAFT AND HOUSING ASSEMBLY - Replace Anti-Ice Seal Part No. 3071397-2
72-3081	No Effect	ENGINE - LOW PRESSURE TURBINE ASSEMBLY - Install Nameplate on Low Pressure Turbine Assembly Part No. 3072276-X for Configuration Control of Low Pressure Turbine Module Assembly
72-3085, Rev 5	No Effect	ENGINE - FAN SPINNER - Replace Fan Spinner and Related Anti-Ice Components
72-3092, Rev 1	No Effect	ENGINE - ACCESSORY DRIVE GEARBOX ASSEMBLY - Install Elastromeric Mounts
72-3095	No Effect	ENGINE - TURBINE SECTION - Replace No. 4 and 5 High Pressure Rotor Carbon Face Seal for Improved Sealing Capability and Increased Seal Life
72-3098	No Effect	ENGINE - FAN SHAFT ASSEMBLY - Rework Fan Shaft, Part No. 3071955-1
72-3103, Rev 1	No Effect	ENGINE - COMBUSTION SECTION - Rework Combustion Chamber Liner Part No. 3072448-4 to Part No. 3072674-1
72-3105, Rev 1	No Effect	ENGINE- INSPECTION INTERVALS - Establishing Major Inspection Intervals
72-3113	No Effect	ENGINE - SUPPORT HOUSING - Replace Support Housing
72-3116	No Effect	ENGINE - LOW PRESSURE COMPRESSOR - Install Air-Oil Seal Rotors with Improved Surface Coating
72-3119	No Effect	ENGINE - TURBINE SECTION - Decrease Turbine End Shaft Stretch Dimension on Low Pressure Tie Rod
72-3126, Rev 5	No Effect	ENGINE - PLANET GEAR INSTALLATION - Replace Planet Gearshaft Assembly
72-3133	No Effect	ENGINE - FAN BY-PASS STATOR INSTALLATION - Inspect and Replace Fan By-Pass Stator Alignment Pins

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Service Bulletin	Incorp.	Title
72-3136, Rev 1	No Effect	ENGINE - ACCESSORY DRIVE GEARBOX - Replace Annular Ball bearings, Part No. 358206
72-3137, Rev 2	No Effect	ENGINE - COMPRESSOR INSTALLATION - Incorporate HP Rotating Group Thrust Balance Seal Rotor (Cancelled)
72-3138	No Effect	ENGINE - HIGH PRESSURE ROTOR AND NOZZLE ASSEMBLY - Replace Inner Diameter Bolts and Sequence Nozzle Segments
A72-3140	No Effect	ENGINE - COMPRESSOR INSTALLATION - Replace Tie Rod
73-3001	No Effect	ENGINE FUEL AND CONTROL - FUEL PUMP ASSEMBLY - Replace Fuel Pump Assembly
73-3003	No Effect	FUEL - CONTROLLING - Improved Fuel Pump Assembly
73-3004	No Effect	FUEL - CONTROLLING - Check for Presence of Fuel Pump Anti-Icing Valve
73-3005	No Effect	FUEL - CONTROLLING - Inspection Reidentification or Replacement of Fuel Pump Assembly
73-3008	No Effect	FUEL - CONTROLLING - Replace Fuel Control with Fuel Control Incorporating New Metering Valve Part No. 893513-4 and New Metering Valve Set Part No. 3070877-1 and Restrictor Part No. 3070874-1
73-3009, Rev '	No Effect	ENGINE - FUEL - Cap Flow Divider Drain Port
73-3011, Rev 2	No Effect	ENGINE - CONTROLLING - Install Common Fuel Control on all Turbofan Engines - Install Pressure (PCD) Limiter with Separate Identity, Depending upon Fuel Control Application
73-3013	No Effect	ENGINE - FUEL CONTROL - Remove the 3070900 Name Plate from the Fuel Control Assembly
73-3015, Rev 1	No Effect	ENGINE - FUEL DISTRIBUTION - Replace Fuel Nozzle Gaskets
73-3016, Rev 1	No Effect	ENGINE - FUEL MANIFOLD INSTALLATION - Replace Fuel Manifold Assembly

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Service Bulletin	Incorp.	Title
73-3017	No Effect	FUEL - CONTROLLING - Install Fuel Control Part No. 3070800-8
73-3018, Rev 2	No Effect	ENGINE - CONTROLLING - Install Fuel Control Part No. 3070800-7
73-3019	No Effect	ENGINE - FUEL - Distribution of Sperry Vickers Service Bulletin PPF4-094-73-01, Retention of Filter Guide in PPF4-094 Series Vane Fuel Pump Assembly
73-3020	No Effect	ENGINE - SERVICE TUBES CLAMP AND TUBES INSTALLATION - Replaces P3 Tube with Larger Tube and Install Larger Clamps
73-3021	No Effect	ENGINE - FUEL CONTROL - Add Packings to Manual Mode and Overspeed Solenoids to Prevent Moisture Leakage into Fuel Control
73-3022	No Effect	ENGINE - FUEL CONTROL - Install Improved Metering Valve to Prevent Servo Pressure Regulator Valve Oscillation
73-3027, Rev 2	No Effect	ENGINE - FUEL AND CONTROL - Replace Fuel Pump Assembly with Fuel Pump Assembly Incorporating Fuel Inlet Temperature Boss
73-3028	No Effect	ENGINE - FUEL - Replace Flow Divider and Drain Valve with New Flow Divider without Drain Function
74-3002, Rev 4	No Effect	ENGINE IGNITION - Replace Igniter Plug, Igniter Gasket and Attaching Bolts and Repair Igniter Lead
75-3002	No Effect	AIR - ENGINE ANTI-ICING - Inspect Threaded Insert for Mounting Anti-Ice Seal and Support and Replace when Required
75-3004	No Effect	ENGINE - MANIFOLD AND ANTI-ICE VALVE INSTALLATION - Replace Anti-Ice Manifold Gasket Part No. 3072093-1 and Seal Housing Part No. 3072090-1
75-3007, Rev 2	No Effect	ENGINE - ANTI-ICE SYSTEM - Incorporate Improved Buffered Air System Components, to Increase Anti-Ice System Reliability

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Service Bulletin	Incorp.	Title
75-3008, Rev 1	No Effect	ENGINE - ANTI-ICE SYSTEM - Incorporate Improved Face Bellows Seal Part No. 3072683-3 or -4
76-3002	No Effect	ENGINE CONTROLS - POWER CONTROL - Removal of Latching Function of Overspeed Protection Circuit on Electronic Computer
76-3004	No Effect	ENGINE - CONTROL - Remove and Replace Electronic Computer
A76-3005	No Effect	ENGINE - CONTROL - One Time Inspection of Transistors within Electronic Computer Part No. 949572-5, Series 4, 5, and 6
76-3007	No Effect	ENGINE - CONTROL - Remove and Replace Electronic Computer
76-3008	No Effect	ENGINE CONTROLS - POWER CONTROL - Replace Pneumatic Modulating and Shutoff Valve
76-3009, Rev 1	No Effect	ENGINE - POWER CONTROL - Replace Solenoid Controller Valve
76-3010	No Effect	ENGINE - CONTROL - One Time Inspection of Electronic Computer Part No. 949572-5 or 949572-8
77-3001, Rev 1	No Effect	ENGINE - N1 MOTIONAL PICKUP - Install N1 Transducer with Change in Design and Functional Requirements
77-3002	No Effect	ENGINE - N2 MOTIONAL PICKUP - Install N2 Transducer Incorporating Improved Sealant to Better Withstand the Operating Environment
77-3003, Rev 2	No Effect	ENGINE - THERMOCOUPLE HARNESS - Rework Thermocouple Harness to Eliminate Moisture Problem
79-3004, Rev 1	No Effect	OIL - COOLING - Rework and Replacement of Oil Cooler Transfer Tubes
79-3005, Rev 1	No Effect	ENGINE - OIL DISTRIBUTION - Installation of New Two Piece Number Three Oil Jet
79-3007	No Effect	ENGINE - ACCESSORY DRIVE GEARBOX ASSEMBLY - Remove and Replace Breather Pressurizing Valve

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Service Bulletin	Incorp.	Title
79-3008	No Effect	ENGINE - OIL TANK FILLER TUBE INSTALLATION - Rework of Oil Tank and Oil Filler Tube Adapter and Cap
79-3009, Rev 1	No Effect	ENGINE - OIL - Testing of Engine Oil for the Presence of Fuel
79-3012, Rev 1	No Effect	ENGINE - OIL DISTRIBUTION - Replace Lube and Scavenge Oil Pump
79-3013, Rev 3	No Effect	ENGINE - OIL - Replace Flow Control Thermostat of Oil Temperature Control Valve
79-3014, Rev 4	No Effect	ENGINE - OIL - Replace Thermostat Assembly of Oil Temperature Regulator (Fuel/Oil Cooler)
79-3015, Rev 1	No Effect	ENGINE - OIL - Install Check Valve Part No. 3072693-1 in Oil Vent Line (Cancelled)
79-3017, Rev 1	No Effect	ENGINE - OIL COOLER INSTALLATION - Replace Air/Oil Cooler and By-Pass Valve to Prevent Oil Leakage by Reducing Fretting at Flow Connections
79-3019, Rev 2	No Effect	ENGINE - OIL LINE INSTALLATION - Replace Tube Assembly to Transfer Gearbox to Prevent Interference with Fuel Flow Meter Electrical Connector
79-3022, Rev 1	No Effect	ENGINE - OIL - Replace Oil Tubing to Gearbox and Fuel/Oil Cooler
79-3023	No Effect	ENGINE OIL - DISTRIBUTION - Installation of Redesigned Oil Cooler Oil Transfer Tube

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Spare Parts Bulletin	Incorp.	Title
TFE0001	No Effect	ENGINE - TRANSFER GEARBOX ASSEMBLY - Install Speed Pickup Spacer with Interference Fit to Prevent Relative Rotation
TFE0007	No Effect	ENGINE - FAN DUCT SET - Provide Washer Part No. NAS620C416L with Reduced OD at Fan Duct Longitudinal Flange to Prevent Interference with Fillet Radius
TFE0008	No Effect	ENGINE - FAN DUCT SET - Replace Screw for Cover Part No. 3071952-1 to make Compatible with Existing Hardware
TFE0009	No Effect	ENGINE - COMPRESSOR INTERSTAGE DIFFUSER ASSEMBLY - Install Nut with Thicker Anti-Rotation Flange for Improved Anti-Rotation
TFE0010, Rev 1	No Effect	ENGINE - OIL LINES AND INNER FUEL LINE MANIFOLD INSTALLATION - Change to Improved Insulation and Sealant which are Applicable at Higher Temperature (Cancelled)
TFE0011, Rev 1	No Effect	ENGINE - TURBINE SECTION - Replace First and Second Stage Turbine Blades (Cancelled)
TFE0015, Rev 1	No Effect	ENGINE - FUEL HEATER TUBE INSTALLATION - Change Clamping Arrangement for Fluid Transfer Tube Part No. 3072636-1 to Reduce Possibility of Misalignment During Clamping
TFE0016	No Effect	ENGINE - PINION GEAR ASSEMBLY - Install Longer Bolt for Pinion Gear Retainer Plate
TFE0018	No Effect	ENGINE - ENGINE WIRING HARNESS - Provide Additional Clamp to Reduce Possibility of Nacelle Interfering with Engine Wiring Harness
TFE0020	No Effect	ENGINE - FAN DUCT - Replace Bolt and Nut on High Pressure Bleed Boss with Bolt and Nut Utilizing Different, Self-Locking Features
TFE0021	No Effect	ENGINE - PRESSURE LIMITER VALVE ASSEMBLY - Replace Spring Part No. 3070585-1 with Part No. 3070872-1
TFE0024	No Effect	ENGINE - WIRING HARNESS INSTALLATION - Additional Support to Prevent Rubbing at Housing Split Line

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Spare Parts Bulletin	Incorp.	Title
TFE0026	No Effect	ENGINE - COMBUSTION SECTION - Incorporate Combustion Chamber Plenum Case Part No. 3072443-3
TFE0027	No Effect	ENGINE - ACCESSORY DRIVE GEARBOX - Replace Nut Lock Key Part No. 73563-22 with Part No. 73563-23
TFE0028	No Effect	ENGINE - FUEL CONTROL ASSEMBLY - Replace Packing Part No. S9412-015, Used on Governor Lever Sleeve Part No. 3070609-1, with Packing Part No. S9413-015. Add Restrictor Part No. 895448-4 and -5 to Enhance Attainment of Desired Fuel Pressure Setting
TFE0029	No Effect	ENGINE - BY-PASS DUCT PANEL - Screws Part No. NAS1100CE3-10 Used to Attach Forward End of Left Hand By-Pass Panel have been Replaced by Part No. NAS1101CE3-10
TFE0030	No Effect	ENGINE - ACCESSORY DRIVE GEARBOX - Gearbox Access Cover Part No. 3071382-1 has been Replaced by Part No. 3071382-2
TFE0032, Rev 2	No Effect	ENGINE - IGNITER PLUG AND LEADS INSTALLATION - Install Plug with Thicker Flange to Prevent Bending (Cancelled)
TFE0033, Rev 2	No Effect	ENGINE - THERMOCOUPLE HARNESS - Install Improved Thermocouple Harness Part No. 3071849-5
TFE0034	No Effect	ENGINE - ACCESSORY DRIVE HOUSING - Replace Alternator Shaft Seal for Better Seating Capability
TFE0035	No Effect	ENGINE - FAN SHAFT AND HOUSING ASSEMBLY - Install Gasket of Manufactured Different Material
TFE0036, Rev 1	No Effect	ENGINE - LOW PRESSURE COMPRESSOR AIR - OIL SEAL - Replace Air-Oil Seal Rotor (Cancelled)
TFE0037	No Effect	ENGINE - WIRING HARNESS INSTALLATION - Additional Support to Prevent Rubbing on Transfer Gearbox Nameplate
TFE0039	No Effect	ENGINE - PLANET GEAR ASSEMBLY - Install Longer Stud to Provide Required Thread Protrusion Thru Nut

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Spare Parts Bulletin	Incorp.	Title
TFE0040	No Effect	ENGINE - LOW PRESSURE COMPRESSOR ASSEMBLY - Replace LP Fourth Stage Axial Compressor Rotor Assembly
TFE0041	No Effect	ENGINE - FAN ROTOR - Replace Seal Part No. 3071967-1 with Seal with Improved Surface Finish
TFE0042	No Effect	ENGINE - FUEL CONTROL - Replace Fuel Control Flow Pressure Filter
TFE0043	No Effect	ENGINE - FUEL AND OIL LINES - Conical Seals Provided to Repair Fuel and Oil Tube Fitting Leakage
TFE0045	No Effect	ENGINE - OIL AND INNER FUEL LINE MANIFOLD INSTALLATION - Replace Tubing Insulators
TFE0046	No Effect	ENGINE - FAN SUPPORT SHAFT AND HOUSING ASSEMBLY - Replace Fan Shaft Seal Rotor
TFE0047, Rev 1	No Effect	ENGINE - TURBINE SECTION - Replace HP Turbine Shroud Attaching Bolt
TFE0048	No Effect	ENGINE - COMPRESSOR SECTION - Replace No. 3 Stationary Oil Seal
TFE0049	No Effect	ENGINE - TRANSFER GEARBOX ASSEMBLY - Install Speed Pickup Spacer with Tighter Tolerance Control
TFE0050	No Effect	ENGINE - INDICATING - Install Thermocouple Harness with Increased Insulation Resistance at High Temperature
TFE0051, Rev 1	No Effect	ENGINE - BY-PASS - Install Balanced Clamp Nuts on Planetary Gearshaft Assembly
TFE0052, Rev 1	No Effect	ENGINE - FAN SUPPORT SHAFT AND HOUSING ASSEMBLY - Replace No. 1 Fan Carbon Face Stationary Oil Seal
TFE0053	No Effect	ENGINE - OIL TEMPERATURE REGULATOR (FUEL/OIL COOLER) AND FUEL HEATER - Include Additional Packing Part Number to Provide Alternate Parts
TFE0054	No Effect	ENGINE - OIL TANK INSTALLATION - Replace Liquid Level Gage to Provide Better Sealing

SERVICE BULLETIN LIST (CONT)

Spare Parts Bulletin	Incorp.	Title
TFE0056, Rev 1	No Effect	ENGINE - OIL PUMP AND CHIP DETECTOR INSTALLATION - Install Improved Chip Detector
TFE0057	No Effect	ENGINE - HIGH PRESSURE COMPRESSOR - Replace Diffuser Vane Deswirl to Prevent Disengagement from HPC Diffuser
TFE0058	No Effect	ENGINE - HP SHAFT AND COMPRESSOR INTERSTAGE DIFFUSER - Replace No. 4 Seal with Seal Having New Fastener System to Prevent Accidental Disassembly During Routine Handling
TFE0059	No Effect	ENGINE - INTERMEDIATE CASE ASSEMBLY - Replace No. 3 Seal with Seal Having New Fastener System to Prevent Accidental Disassembly During Routine Handling
TFE0060	No Effect	ENGINE - GEARSHAFT, SEAL, BEARING, DIFFUSER AND SUPPORT ASSEMBLY - Replace No. 5 Seal with Seal Having New Fastener System to Prevent Accidental Disassembly During Routine Handling
TFE0061, Rev 1	No Effect	ENGINE - BY-PASS SECTION - Include Additional Fan Rotor Blades to Provide a Greater Selection by Moment Weight for Repair Installation
TFE0062	No Effect	ENGINE - HIGH PRESSURE ROTOR AND NOZZLE ASSEMBLY - Replace Rotor Seal
TFE0063	No Effect	ENGINE - COMPRESSOR INTERSTAGE DIFFUSER ASSEMBLY - Replace Packing
TFE0064	No Effect	ENGINE - COMPRESSOR INSTALLATION - Replace Tie Rod
TFE0065	No Effect	ENGINE - OIL PUMP - Replace Oil Pump
TFE0066	No Effect	ENGINE - ACCESSORY DRIVE GEARBOX - Replace Breather Pressure Valve
TFE0069	No Effect	ENGINE - SURGE BLEED - Replace Pneumatic Shutoff Valve

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INTRODUCTION

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INTRODUCTION

1. General

A. This publication provides service instructions for support of engines manufactured by The Garrett Turbine Engine Company, A Division of The Garrett Corporation, P.O. Box 29003, Phoenix, AZ 85038. Specific engines covered in this publication are listed on the title page.

CAUTION: REFER TO FEDERAL AVIATION REGULATION, PART 43, OR EQUIVALENT REQUIREMENT FOR COUNTRIES OTHER THAN UNITED STATES, FOR MAINTENANCE THAT MAY BE PERFORMED BY PERSONS OTHER THAN FAA CERTIFIED PERSONNEL.

B. The service instructions provided within this publication detail the maintenance procedures that are required to support Recommended Routine Periodic Inspection Requirements (See GENERAL, INSPECTION/CHECK). These procedures can be accomplished by an operator without the aid of special tools or test equipment.

C. The Light Maintenance Manual, Report No. 72-02-02 provides instructions for procedures requiring special tools or test equipment.

D. This publication is prepared generally in accordance with Air Transport Association Specification No. 100. Definitions of words and terms used in this publication are as stipulated therein.

2. How to Use This Service Manual

A. General

The manual is divided into subjects in accordance with Air Transport Association Specification No. 100.

The material contained within this publication is subdivided into reasonably small topics for ready reference and ease of revision.

To accomplish this, page number blocks are used to separate subjects into topics. It is necessary to use a standard page block system so that topics may be broken out for special distribution. Page number blocks used are as follows:

Description and Operation	1 through 100
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Index tab sheets are used to subdivide this publication for ease in locating specific information.

2. B. Engine Identification System

Each engine is provided with a nameplate for identification of the engine. Information supplied on the engine nameplate includes model number, part number and serial number. The model number defines significant features and specification ratings. The part number defines a group of specific configurations. All engines with the same part number are interchangeable. The part number is supplemented by a series number, and if applicable, change numbers to define a specific configuration. A series number is assigned at engine manufacture or overhaul to identify product improvement changes incorporated beyond the initially manufactured configuration. Individual changes incorporated which are not within the series grouping are identified separately by change numbers. Changes represented by series and change numbers are product improvements and do not affect interchangeability of the engine. Refer to the engine log book for changes incorporated since engine production which are not separately identified on the nameplate.

Each assembly of the engine which is a complete unit has a separate nameplate carrying part number, serial number and product improvement change information. Any assembly is interchangeable with assemblies having the same part number.

C. Effectivity Code System and Configuration Notation System

Some of the instructions and information contained in this publication are applicable only to specific engine model numbers, engine series/serial numbers or pre or post service bulletin configurations of engines. When this occurs, the applicability of the material is noted at the beginning of the paragraph, procedural step, table title, or figure title. When the applicability of material is to certain engine model numbers only, applicability is specified by effectivity codes representing engine model numbers. An effectivity code is assigned for each engine model number in Table 1, Effectivity Code List. When material is applicable only to specific engine series/serial numbers, or only to configurations which are pre or post service bulletin compliance, effectivity is specified by direct reference to engine series/serial numbers or service bulletin number.

3. Applicable Publications

Other publications applicable to equipment specified in this publication are listed in Table 2 by report number, along with nomenclature and part number of the equipment covered. Separate publications for components of the engine, when available, are referenced in the text where applicable and listed in Table 2.

4. Abbreviations

None.

Table 1. Effectivity Code List

Engine Model No.	Engine Part No.	Code Symbol
TFE731-2-1C	3070000-1/-2/-3/-4/-5/ -6/-7/-8/-9/-10/-11/ -12/-13	-

Table 2. Applicable Publications List

Nomenclature	Part No.	Publication	Type
*Turbofan Aircraft Engine	3070000-1/-2/ -3/-4/-5/-6/ -7/-8/-9/-10/ -11/-12/-13	72-00-71	IPC
*Turbofan Aircraft Engine	3070000-1/-2/ -3/-4/-5/-6/ -7/-8/-9/-10/ -11/-12/-13	72-02-02	LMM

*Illustrated Parts Catalog and Light Maintenance Manual are included in Microfiche in envelope under tab labled Microfiche.

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CHAPTER 70 - STANDARD PRACTICES - ENGINE

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STANDARD PRACTICES - ENGINE - GENERAL

1. General

The standard practices and general maintenance instructions presented in this chapter are recommended by the engine manufacturer. Frequent reference shall be made to this chapter by personnel engaged in maintenance activities outlined in this publication.

2. Standard Disassembly Procedures

Table 1. Material and Compounds

Material or Compound	Manufacturer
CAUTION: ANY SUBSTITUTES USED FOR LISTED INDUSTRIAL MARKING INK OR YELLOW CHINA MARKER SHALL CONTAIN NO CARBON.	
NOTE: Equivalent substitutes may be used for listed items.	
Industrial marking ink (Violet, No. 127-1/2)	Pannier Corp, 207 Sandusky St, Pittsburgh, PA 15212
Solvent, Stoddard (Federal Specification P-D-680, Type I or II)	Commercially available
Yellow china marker (No. 170T)	Blaisdell Pencil Co, Philmont Rd, Bethagres, PA 19006

A. Observe Following General Procedures Throughout Disassembly or Removal Operations

(1) Always keep ports, bores and passages of assemblies or components sealed with suitable plastic closures between maintenance procedures. Cover large openings with plastic sheeting. Do not use tape, cardboard or cloth.

2. A. (2) Record manner of lockwiring for duplication at reassembly.

CAUTION: DO NOT USE ANY MARKING DEVICE CONTAINING CARBON.

(3) Use yellow china marker (No. 170T) or industrial marking ink (Violet, No. 127-1/2) for marking. Remove all marks at completion of task using solvent, Stoddard (Federal Specification P-D-680, Type I or II).

3. Standard Reassembly Procedures

Table 2. Materials and Compounds

Material or Compound	Manufacturer
NOTE: Equivalent substitutes may be used for listed items.	
Lint-free cloth	Commercially available
Lubricant (OS-124 or Santovac 5)	Monsanto Co, 800 N Lindbergh Blvd, St Louis, MO 36166
Solvent, Stoddard (Federal Specification P-D-680, Type I or II)	Commercially available

A. Observe Following General Procedures at Reassembly

(1) Exercise extreme care to prevent dirt, dust or foreign particles from entering the engine. If any foreign particle is dropped into the engine during maintenance, stop work until foreign particle is located and removed.

(2) Cover large openings with plastic sheeting for added protection to the engine. Cap open tube ends. If the engine is to be left for even a short period in a partially disassembled state, cover or cap all openings.

(3) Be sure all parts are thoroughly clean before assembly. Wipe all parts and surfaces with a clean, lint-free cloth.

3. A. (4) Observe all specified torque values during reassembly.

(5) At completion of assembly of any components marked for indexing, remove index marks using solvent, Stoddard (Federal Specification P-D-680, Type I or II).

(6) O-ring type packings used in engine pneumatic systems may be installed without lubricant. Packings used in engine fuel system may be coated with a light coat of engine fuel. Packings used in engine oil system may be coated with a light coat of engine oil. Ensure there is not contamination or excessive lubricant on packings at assembly. As an alternative, any packing may be lubricated with lubricant (OS-124 or Santovac 5).

(7) Whenever torque values are identified in the applicable chapter/section/subject covering the part, these specified torque values do not include frictional torques developed by self-locking devices or "run-down" resistance. The frictional resistance or "run-down" torque must be added to the specified torque. When torque is applied to the bolt and the nut is held stationary, the higher value shall be used. When torque values are not specified, conform to standard shop practice or sources such as FAA Manual AC65-9, Airframe and Powerplant Mechanics General Handbook.

(8) Minimum running torque values have been established for several sizes of bolts and self-locking female threads. Bolts and inserts with running torques less than the below minimums shall be replaced.

Bolt/Insert Size	Minimum Running Torque
No. 8	4 in.-lb
No. 10-32	6 in.-lb
0.250 in.	6 in.-lb

(9) Whenever torque values are not identified in the applicable chapter/section/subject, follow general guidelines listed in Tables 3 and 4 for tightening small fasteners.

NOTE: Fasteners installed through essentially inelastic boundaries will first be tightened to remove visible clearance between parts. During this initial tightening of the fastener, the "run-down" resistance shall be noted on the last rotation just before establishment of a tensile preload in the fastener. The fastener shall then be given a steady additional tightening movement by the wrench to produce a final torque, that is approximately equal to the "run-down" torque plus the values shown in Table 3 for the respective thread size. This procedure will produce +35/-35 percent accuracy which is adequate for all items not listed under torque values below. As a further assistance, Table 4 gives general guidelines for obtaining the final torque.

Table 3. Tightening Small Fasteners

Thread Size	Torque (in.-lb) Aluminum Fastener	Cres Fastener
6	5	10
8	10	20
10	15	35
1/4	45	75
5/16	80	160
3/8	140	275

Table 4. Tightening Small Fasteners

Thread Size	Approximate Rotation After Run-Down
6-32	45 deg
8-32	60 deg
10-24	40 deg
1/4-20	40 deg
5/16-18	40 deg
3/8-24	60 deg

3. A. (10) Unless otherwise specified, flared tubing fittings (when not used with conical seals) and hose fittings shall be tightened to torque values specified in Table 5.

Table 5. Standard Torque Values for Flared Tubing Fittings (Conical Seals Not Used) and Hose Fittings

Tube Dash No.	Torque, Aluminum Parts (in.-lb)	Torque, All Steel Parts (in.-lb)
2	12-15	35-40
3	20-35	70-80
4	40-60	100-120
5	65-85	140-160
6	100-120	190-220
7	140-160	240-280
8	180-220	300-350
10	270-330	440-500
12	360-440	600-660
16	500-620	840-960
20	660-780	1080-1320
24	800-960	1500-1800
28	960-1140	2160-2520
32	1080-1320	2400-2880

(11) Conical seals are used at specific locations during engine production to preclude leakage. However, conical seals may be used at any flared tubing fitting of appropriate size in fuel and oil systems as a repair to correct leakage at the option of the user.

CAUTION: PROPER INSTALLATION OF CONICAL SEALS DESCRIBED IN THE FOLLOWING STEP IS ESSENTIAL TO AVOID FLOW RESTRICTION OR SUBSEQUENT LEAKAGE. CONICAL SEALS ARE TO BE USED ONLY ONCE. ENSURE THAT PREVIOUSLY INSTALLED CONICAL SEAL IS REMOVED FROM PLUMBING FITTING BEFORE INSTALLING NEW CONICAL SEAL.

3. A. (12) Unless otherwise specified, flared tubing fittings when used with conical seals shall be tightened to torque values in Table 6. When conical seals are used, install conical seals and tighten fittings as follows.

(a) Select proper conical seal part number for tube assembly being installed. (Refer to table 6.)

(b) Lubricate conical seal and threads of plumbing fitting with clean engine oil (72-00-00, GENERAL - SERVICING).

CAUTION: DO NOT INSTALL CONICAL SEAL INTO TUBE NUTS. SEAL SHALL BE INSTALLED ON MALE FITTING ONLY.

(c) Install conical seal onto male flare portion of plumbing fitting. Flats on conical seal are designed to provide proper positioning of seal onto plumbing fitting to prevent cocking of seal that could cause flow restriction.

(d) Thread tube nut onto plumbing fitting several turns with fingers until joint is snug. If tube nut cannot be tightened snugly with fingers, disassemble and correct problem to prevent assembly damage to conical seal.

CAUTION: USE CARE NOT TO TIGHTEN TUBE NUTS MORE THAN SPECIFIED TO AVOID DAMAGING SEAL. DO NOT LOOSEN TUBE NUT AFTER INITIAL TORQUE APPLICATION WITHOUT REPLACING CONICAL SEAL.

(e) Tighten tube nuts as follows. Conical seal is subject to cold creep; therefore, a double tightening procedure is required.

1 Tighten tube nuts to torque value specified in Table 6. Torque values are higher than torque values for tube nuts without conical seals installed.

2 Allow five minutes elapsed time for cold creep to occur.

3 Recheck torque on tube nut and, if required, further tighten to torque value specified in Table 6.

Table 6. Standard Torque Values for Flared Tubing Fittings Used With Conical Seals

Tube Dash No.	Conical Seal Part No.	Torque (in.-lb), All Steel Parts
3	651-525-9003	110 to 125
4	651-525-9004	165 to 190
5	651-525-9005	225 to 250
6	651-525-9006	335 to 375
8	651-525-9008	575 to 675

4. Replaceable Components

A. General

(1) In addition to the replaceable components outlined in other chapters in this publication, all plumbing, tubing, fittings, brackets, grommets, and common hardware are replaceable.

(2) All packings and gaskets removed during maintenance shall be replaced with new packings and gaskets.

(3) All retaining hardware which have tabs to be bent at installation (tabbed locking washers, etc.) shall be replaced when removed and parts with tabs that have been previously bent shall not be reused.

(4) All female threaded devices incorporating self-locking feature shall be either replaced at reassembly or self-locking feature shall be verified to be satisfactory at time of reassembly, as evidenced by noticeable drag when mating part is threaded into self-locking part.

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*Trouble shooting procedures contained in this manual are general in nature and only isolate the malfunctioning system. Detailed Trouble Shooting procedures are provided in Light Maintenance Manual, Report No. 72-02-02.

CHAPTER 72 - DESCRIPTION AND OPERATION

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GENERAL - DESCRIPTION AND OPERATION

1. Engine

The TFE731 Engine is a lightweight, two-spool geared transonic-stage, front-fan, jet-propulsion engine for aircraft. The engine is modularized for ease of maintenance. Design simplicity and inherent sturdiness eliminate the need for aerodynamic inlet guide vanes, variable geometry and other similar complexities, and thereby minimize inlet icing and reduce noise and weight. In addition to a high-bypass ratio, the engine incorporates recent design developments to minimize engine generated noise to a level appreciably below that of competitive business jet engines. The use of a reverse-flow annular combustor diminishes engine length and provides the advantage of the cool-skin concept for the external surfaces of the turbine section. An annular duct serves to bypass fan air for direct thrust.

A spinner hub and an axial-flow fan are located at the forward end of the engine and are gear-driven by the low pressure spool. The low pressure spool consists of a four-stage low pressure compressor and a three-stage low pressure turbine, both mounted on a common shaft. The high pressure spool consists of a high pressure single-stage centrifugal compressor and a high pressure single-stage turbine. The high pressure compressor and turbine are mounted on a common shaft. The high pressure spool drives the accessory section. The spool shafts are concentric and the low-pressure spool shaft passes through the high pressure shaft. (See figure 1.)

Figures 2 through 6 show system functions schematically. Figure 7 shows physical locations of engine components and accessories.

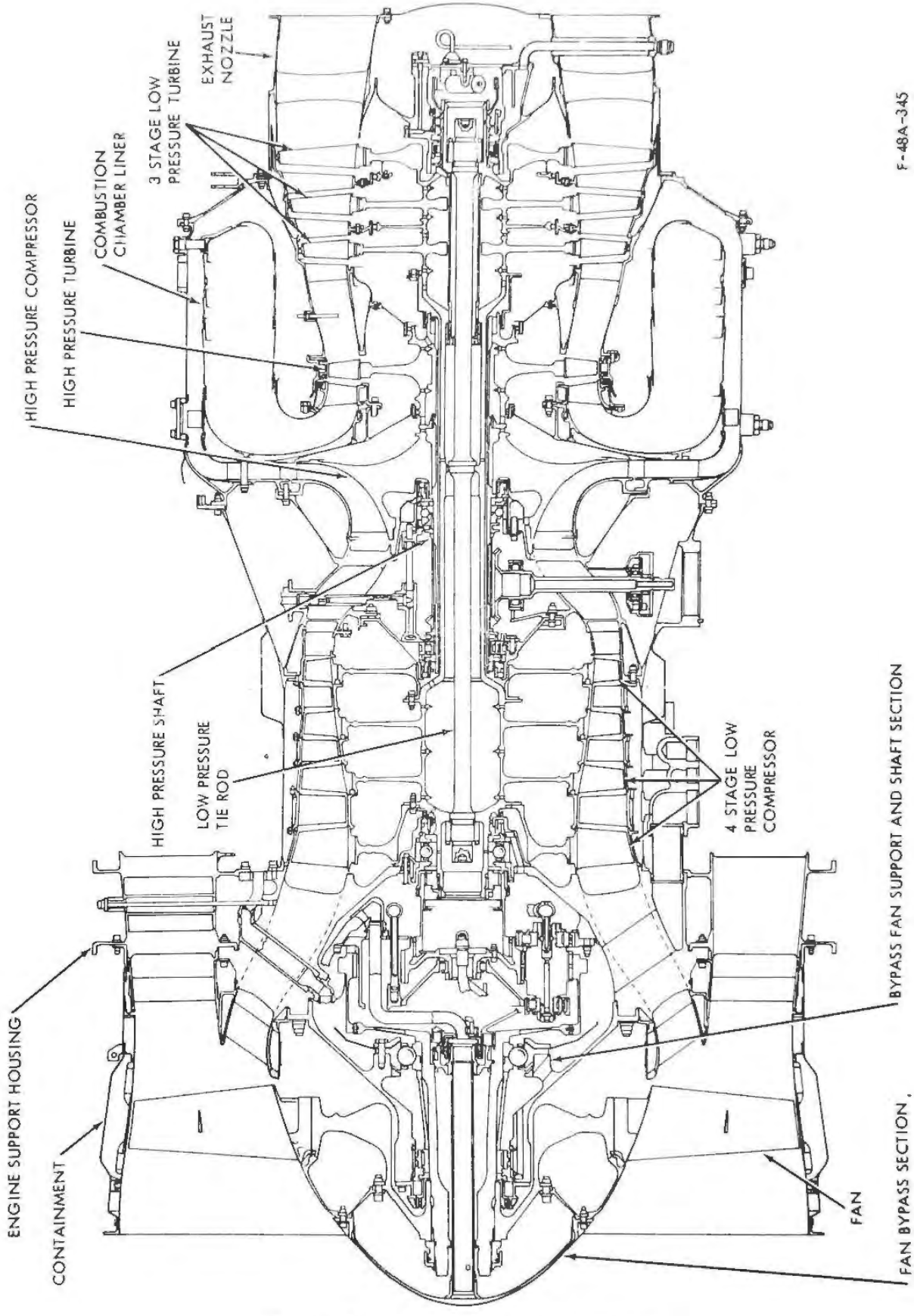
Refer to Table 1 for Leading Particulars.

Table 1. Leading Particulars

Engine Type	Two-spool turbofan engine
Fan	Single-stage geared
Low Pressure Compressor	Four-stage axial
Low Pressure Turbine	Three-stage axial
High Pressure Compressor	Single-stage centrifugal
High Pressure Turbine	Single-stage axial
Dimensions (approx)	
Length	52.83 in.
Width	34.20 in.
Height	39.36 in.

Table 1. Leading Particulars (Cont)

Weight (approx dry weight (lb))	(pre SB 72-3040) 789.5 (post SB 72-3040) 790.5
Ratings	
Absolute Altitude	45,000 ft
Starting Altitude (ground starts)	Sea level to 15,000 ft
Ambient Air Temperature	
Operation	-54 to 52C (-65 to 125F)
Starting	-40 to 52C (-40 to 125F)
Exception: Lowest permissible temperature shall be that at which the fuel viscosity is at or above the pour point.	
Oil Consumption	0.05 gal/hr
Electrical Power (nominal)	28 vdc
Speed	
Low Pressure Turbine Rotor (N1)	20,688 rpm (100 percent)
High Pressure Turbine Rotor (N2)	29,692 rpm (100 percent)
Lubrication System	
Lubrication Specification	Refer to SERVICING, Table 301
Fuel System	
Fuel Specification	Garrett EMS53111, EMS53112, EMS53113 Class A and B, EMS53116 (Refer to Aircraft Flight Manual)
Thrust (uninstalled)	3230 lb



Cross Sectional View of Engine
Less Accessories (Typical)
Figure 1

2. Air Inlet Section

The air inlet section is located in the front of the engine directly behind the fan rotor assembly and is enclosed by the fan inlet and bypass housing assemblies.

3. Fan Bypass Section

The fan provides inlet air for the engine compressor and bypasses a large portion of the inlet air available to the engine for noise reduction and additional thrust. The bypass section consists of the fan spinner, fan spinner support, fan rotor assembly, fan bypass stator, fan duct assembly and the bypass fan support and shaft section.

4. Compressor Section

Inlet air enters the engine through the air inlet section located immediately aft of the fan bypass section. From the air duct it enters the compressor section at the low pressure (four-stage axial) compressor where it is compressed and forced through the interstage diffuser assembly to the high pressure (single-stage centrifugal) compressor.

Air is further compressed by the high pressure compressor and is discharged into the combustion section.

5. Combustion Section

The compressed air flows into a single reverse-flow annular combustion chamber in the turbine section where it is mixed with atomized fuel supplied by twelve duplex fuel nozzles containing primary nozzles used for starting, and secondary nozzles used in conjunction with the primary nozzles for all other phases of engine operation. The fuel-air mixture is ignited by the two igniter plugs. After ignition cutout, combustion is self-sustaining. The resultant combustion gases are directed to the turbine by the transition liner.

The combustion chamber plenum assembly encloses the entire combustion area and provides a plenum for compressed air. The rear end of the plenum assembly provides a register for the turbine bearing support.

6. Turbine Section

The turbine section contains four (one high pressure, three low pressure) axial flow turbine wheels and four stator assemblies. Gases from the combustion section flow through the stator and wheels and exhaust to atmosphere through the thrust and exhaust nozzle.

7. Accessory Drives Section

The accessory drives section consists of a gearbox module for supplying drive power to engine and aircraft accessories. Primary components of the module are a transfer gearbox and an accessory drive gearbox. The transfer gearbox is driven by a vertical shaft from the high pressure spool and drives the accessory drive gearbox through a horizontal shaft. The accessory drive gearbox provides shaft power for aircraft accessories (mounted on the forward face of the accessory drive gearbox), the fuel pump, fuel control and the oil pump.

Three drives are provided on the forward face of the accessory drive gearbox for customer-furnished accessories such as a starter, alternator, hydraulic pump or similar accessories.

The oil pump, mounted on the aft face of the accessory drive gearbox, provides for oil pumping and scavenging. A magnetic chip detector is mounted on the oil pump. The oil pump also has a boss in which a temperature probe may be mounted for measuring fan gearbox scavenge oil temperature. An oil filter and oil filter bypass indicator valve are mounted on the accessory drive gearbox. A fuel filter is mounted on the fuel pump mounted on the accessory drive gearbox. Also mounted on the aft face of the gearbox is a breather pressurizing valve.

8. Engine Fuel and Control System

The engine fuel and control system pressurizes fuel routed to the engine, meters fuel flow, and delivers atomized fuel to the combustion section of the engine. Desired fuel temperatures are maintained with oil-to-fuel heat exchanging.

Fuel flow is controlled by a hydromechanical fuel control, which contains a fuel shutoff section and a fuel metering section. This unit is mounted on the fuel pump and provides the power lever connection point and the fuel shutoff function. The unit provides mechanical overspeed protection for the high pressure rotor during normal (automatic mode) engine operation.

During normal engine operation, a remotely mounted electronic computer performs the functions of thrust setting, speed governing and acceleration and deceleration limiting through electrical control outputs to the fuel control in response to power lever inputs. In the event of electrical or computer failure, or at the option of the pilot, the fuel control will function independently in manual mode to provide for engine operation at reduced power at non-flat rated conditions. The electronic computer also controls the surge bleed control system in normal operation. When the electronic computer is deactivated, the surge bleed valve assumes a one-third open position which allows conservative operation on manual mode operation. A logic diagram of the engine fuel and control system is presented in Figure 2.

The total engine fuel and control system consists of the following components, which provide the functions indicated. (See figure 3, or 4.)

8. A. Fuel Pump

The fuel pump provides high pressure fuel to the engine fuel and control system. The unit consists of a boost pump element, fuel filter, differential pressure indicator (filter bypass valve), high pressure pump element and relief valve.

An anti-icing valve is provided within the fuel pump to mix warm fuel from the fuel heater with the discharge flow of the boost pump to prevent icing of the fuel filter element.

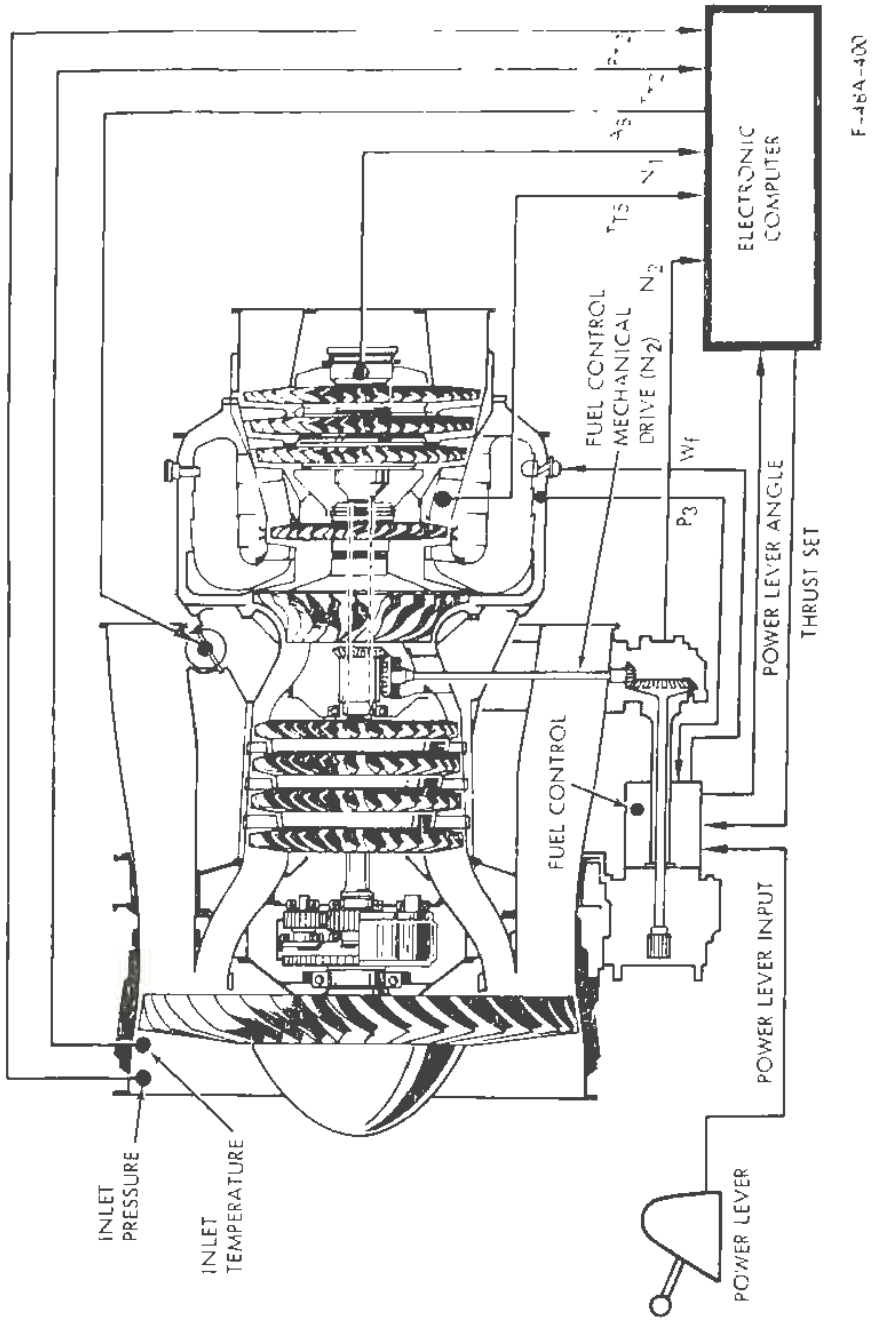
The filter bypass valve on the fuel pump allows bypass of fuel around the fuel filter when the pressure drop across the fuel filter is excessive. An integral delta pressure indicator visually flags an excessive differential pressure condition before bypassing occurs by extending a pin from the valve.

B. Fuel Control

This unit contains the fuel metering section, power lever input, shutoff valve, outlet pressurizing valve, overspeed solenoid, and a mechanical governor that functions as either an overspeed governor for the high pressure rotor or provides manual control when the electronic computer section of the fuel control system is deactivated. When activated, the electronic computer controls fuel flow scheduling by electrically setting the metering section pressure drop within the fuel control in accordance with the power lever and engine inputs.

C. Electronic Computer

The remotely located electronic computer is basically a high pressure rotor speed (N2) governor with provisions for fuel limits during acceleration and deceleration. The computer portion of the fuel control system performs governing, limiting and scheduling functions in response to power lever and engine inputs. An electrical input of 15 to 30 volts dc is required from the aircraft electrical system during all modes of engine operation. Inputs to the electronic computer are engine inlet pressure (PT2) and temperature (TT2), interstage turbine temperature (ITT) (TT5), high (N2) and low (N1) pressure rotor speeds and throttle position (power lever input) for computing engine control parameters. The computer derives a control bleed valve area signal used by the surge bleed control system.



A_B = BLEED AREA

N_1 = LOW PRESSURE SPOOL SPEED

N_2 = HIGH PRESSURE SPOOL SPEED

P_3 = COMPRESSOR DISCHARGE PRESSURE

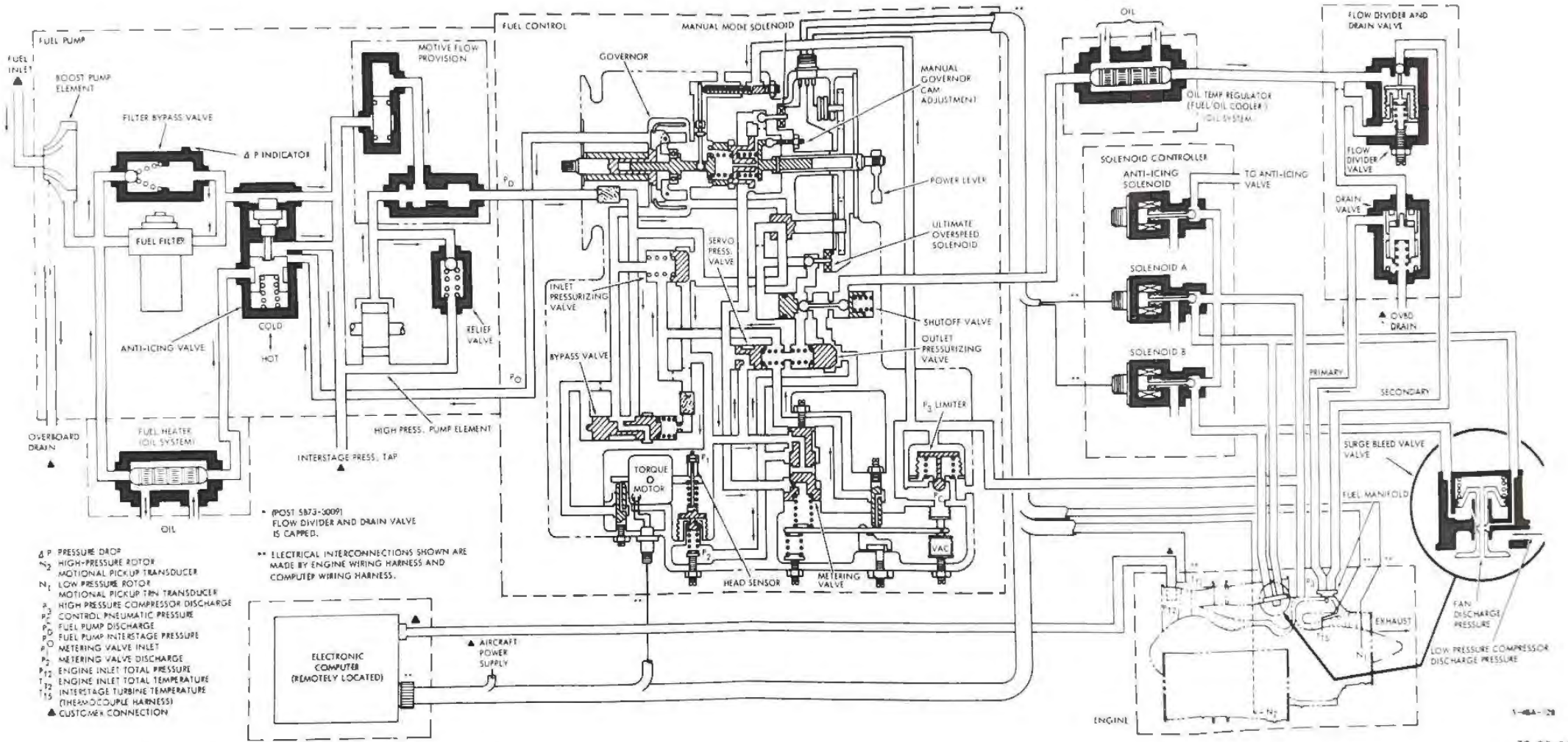
P_{T2} = ENGINE INLET TOTAL PRESSURE

T_{T2} = ENGINE INLET TOTAL TEMPERATURE

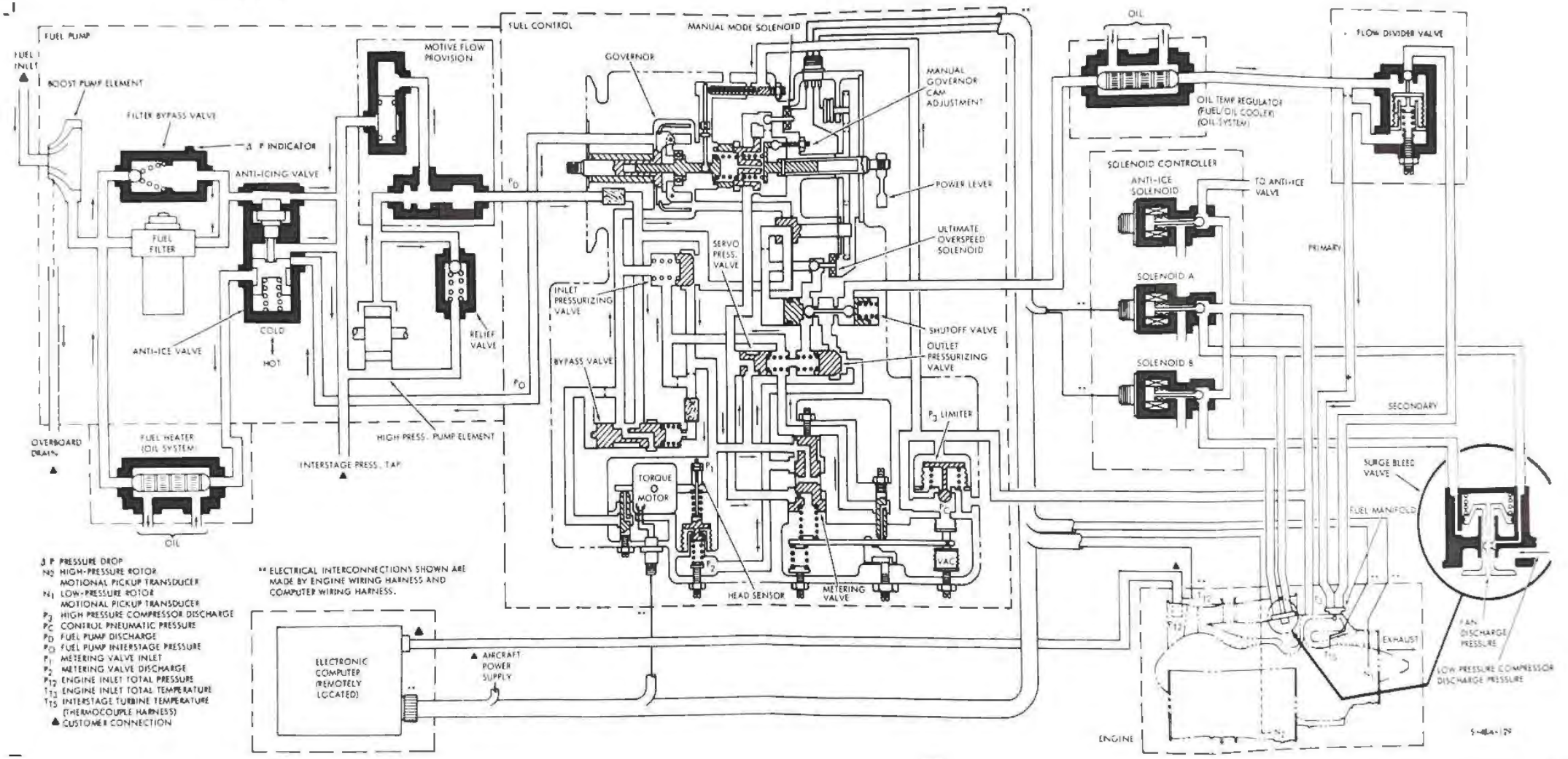
T_{T5} = INTERSTAGE TURBINE TEMPERATURE

W_f = FUEL FLOW

Engine Fuel and Control System
Logic Diagram
Figure 2



(Pre SB 73-3028) Engine Fuel and Control Systems Schematic (Typical)
Figure 3



(Post SB 73-3028) Engine Fuel and Control System and Schematic (Typical)
Figure 4

8. C. Electronic Computer (Con

The computer provides an appropriate output current to the torque motor of the fuel control based on the various input signals. The computer may be controlled by an aircraft manual mode switch and includes an output signal for a cockpit-mounted indicator to show manual mode operation in the event of loss of input power, computer malfunction or pilot deactivation of the computer power. A computer output is provided for actuation of an aircraft speed switch relay at approximately 50 percent high pressure spool rpm. This function may be used to automate the start cycle.

(Pre SB 76-3007) No overspeed protection is supplied by electronic computer during manual mode operation, regardless of the position (on or off) of the cockpit switch for computer activation.

(Post SB 76-3007) No overspeed protection is supplied by the electronic computer during manual mode operation, regardless of the position (on or off) of the cockpit switch for computer activation as long as the NORMAL/MANUAL switch on the face of the electronic computer is set to NORMAL. Overspeed protection circuits of the electronic computer for both low and high pressure spools remain activated in the manual mode provided the cockpit switch for computer activation is on, and the NORMAL/MANUAL switch on the face of the electronic computer is set to MANUAL (assuming N1 and N2 transducer inputs are available to the computer).

(Pre SB 76-3007) When commanded by an aircraft fuel enrichment switch, the electronic computer increases fuel scheduling to assist engine starting. Caution must be exercised not to exceed allowable temperature limits when using this function.

(Post SB 76-3007) The electronic computer automatically provides increased fuel scheduling during engine starts to assist starting. When commanded by an aircraft fuel enrichment switch, the electronic computer maintains increased fuel scheduling beyond the turbine temperature limit of automatic fuel enrichment cutoff to assist engine starting. Caution must be exercised not to exceed allowable temperature limits when using this function.

D. Surge Bleed Control

The surge bleed control consists of two surge valve control solenoids (solenoids A and B) in the solenoid controller valve (solenoid controller) and a modulating and shutoff (surge bleed) valve which is opened to prevent low pressure surge. Bleed valve position is controlled to maintain an adequate margin from engine surge under all operating conditions.

(Pre SB 72-3085) The third solenoid valve (solenoid C) controls operation of the anti-ice valve.

(Post SB 72-3085) A port in the solenoid controller for the third control solenoid (solenoid C) (not used) is plugged.

E. (Pre SB 73-3028) Flow Divider and Drain Valve

This unit controls the routing of fuel during engine starting to ensure proper atomization of the fuel.

(Pre SB 73-3009) The unit also functions to drain the primary nozzles during engine shutdown. A small amount of fuel will flow from the drain fitting on the unit during each normal engine shutdown.

(Series 1-37, Post SB 73-3009) The drain valve boss of the unit is capped.

F. (Post SB 73-3028) Flow Divider Valve

This unit controls the routing of fuel during engine starting to ensure proper atomization of the fuel.

G. Fuel Manifold

This unit provides routing and atomizing of the fuel to ensure proper combustion.

H. Fuel Heating

The fuel heater permits oil-to-fuel heat exchanging to maintain desired temperatures and prevent ice formation in the fuel system from clogging the fuel pump assembly fuel filter. A portion of the engine fuel supply is diverted through the fuel heater by a thermostatically operated anti-ice valve located in the fuel pump assembly.

8. I. Inlet Pressure and Temperature Sensor

An inlet pressure and temperature sensor contains electrical elements for sensing inlet air temperature (TT2) and a pressure tap for sensing inlet air pressure (PT2). Both inlet parameters are required by the electronic computer. An electrical anti-icing element is contained in the sensor. The sensor is located aft of the forward fan inlet flange at the 12 o'clock position.

J. Additional Fuel System Components

Additional fuel system components are the associated fuel lines and plenum drain valves. No fuel is allowed to drain from the plenum in normal operation, but any fuel accumulation during a false start is drained.

9. Electrical System

The electrical system includes engine and aircraft mounted components for engine control and indicating. Control components include the electronic computer, ignition system, solenoid controller and the electrical input section of the fuel control.

Interconnection of components is provided by two electrical harnesses and aircraft wiring.

Indicating components include the thermocouple harness (interstage turbine temperature sensor), N1 (low pressure spool) and N2 (high pressure spool) transducers, and the TT2 (inlet temperature) sensor of the inlet pressure and temperature sensor, and an electrical chip detector.

(Pre SB 72-3085) Indicating components also include an anti-ice pressure switch.

Customer-furnished engine mounted electrical system components may include a starter-generator, alternator, fire detector, oil pressure and temperature sensors, fuel flow and pressure sensors, engine pressure ratio sensor and wiring harness.

10. Ignition System

The engine ignition system is a dual igniter system requiring a dc power input of from 10 to 30 volts for operation. It is capable of accepting overloads of 40 volts for short periods to allow use of series 24 volt batteries for starting. The system includes the ignition unit, igniter plugs and high voltage shielded output cables. Either continuous or intermittent operation is permitted through a cockpit switch. The ignition unit is a solid state, high voltage, capacitor discharge type that provides a spark rate at the igniter plugs of approximately two sparks per second with an output of 18,000 to 24,000 volts.

11. Anti-Icing System

(Pre SB 72-3085) The anti-icing system supplies heated compressor bleed air (P3) from a combustion chamber plenum bleed port to prevent ice formation at the fan spinner. System operation is controlled by an aircraft anti-ice switch. (See figure 5.)

Electrical heating elements are used by the inlet pressure and temperature sensor to prevent ice formation on the sensor. Power is supplied to the electrical heating elements whenever anti-icing is selected.

(Pre SB 72-3085) When anti-icing is selected, the anti-ice solenoid of the solenoid controller is energized. The anti-ice solenoid then shuts off bleed air pressure to chamber A of the anti-ice valve and vents chamber A to ambient. Compressor bleed air pressure in chamber B then unseats the anti-ice valve poppet and permits flow of the heated bleed air. Air flow is directed to the anti-ice pressure switch and components receiving anti-ice air. The anti-ice pressure switch actuates to provide cockpit indication of anti-icing whenever anti-icing air pressure is present.

12. Indicating System

Indicating system components providing cockpit indications include the thermocouple harness (interstage turbine temperature sensor) and N1 and N2 transducers, and the electrical magnetic chip detector.

(Pre SB 72-3085) A cockpit indication is provided for the anti-ice pressure switch.

A. Interstage Turbine Temperature (ITT) (TT5) Sensor

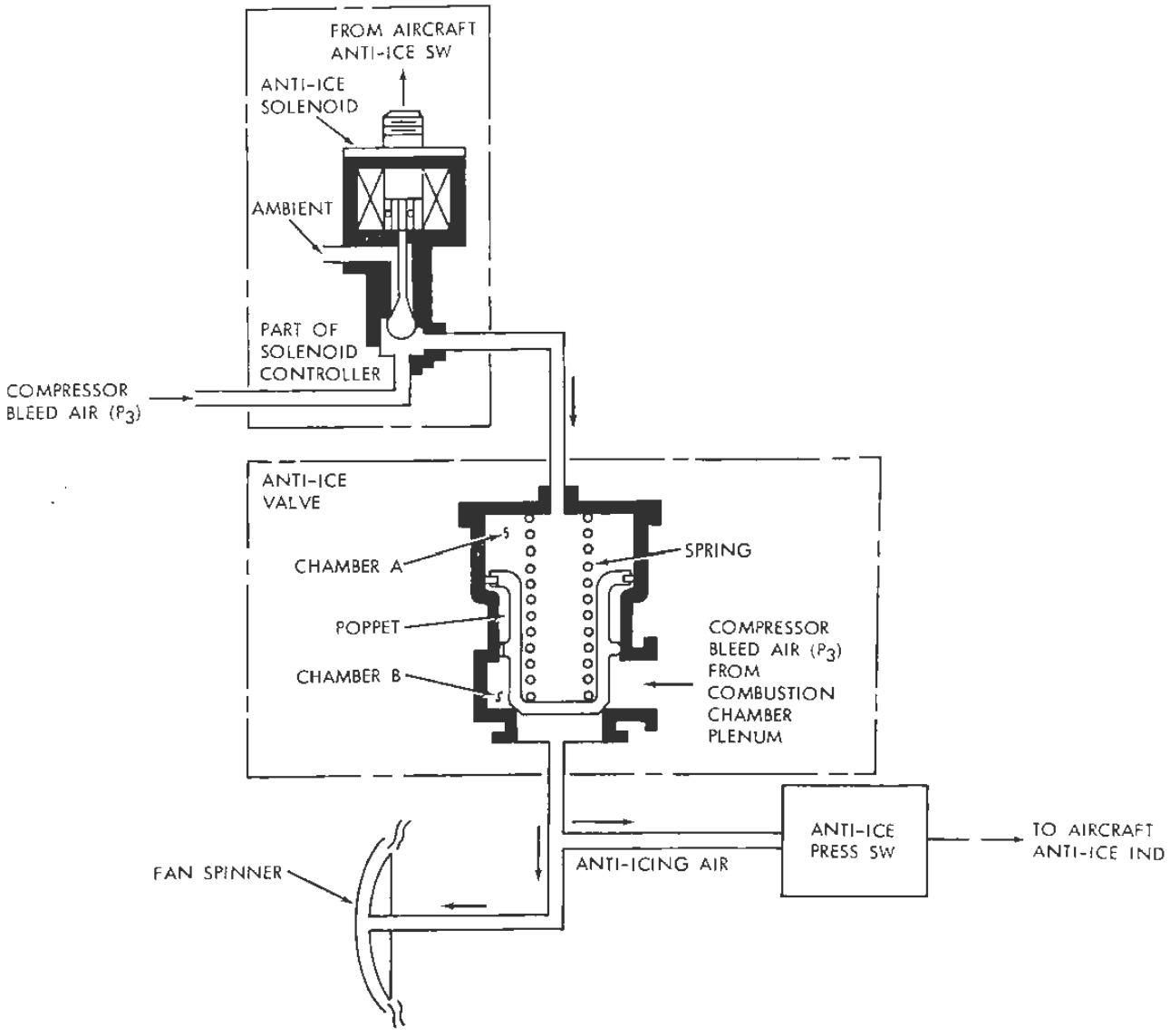
An internally mounted system of parallel thermocouples is positioned between the high and low pressure turbine sections to sense temperature in this section of the engine. Two outputs from the thermocouples are routed from the engine, one for the fuel system electronic computer and the other for cockpit instrumentation.

B. Magnetic Chip Detector

A magnetic chip detector capable of attracting magnetically permeable materials is provided on the engine oil pump.

The chip detector provides a ground circuit for a warning indicator in the cockpit when sufficient magnetic material collects on the detector.

Magnetic material accumulation on the chip detector is checked visually by removing and inspecting the chip detector magnetic plug.



(Pre SB 72-3085) Anti-Icing System Schematic
Figure 5

12. C. N1 and N2 Transducers

Two monopole pickups are provided on the engine for speed sensing of the high and low pressure spools. Each pickup is a dual unit and terminates in a separate connector. One element of each pickup is used by the fuel control system for speed signal inputs to the electronic computer. The remaining element in each pickup is for cockpit instrumentation of the speed of the low pressure (N1) and high pressure (N2) spools.

D. (Pre SB 73-3028) Anti-Ice Pressure Switch

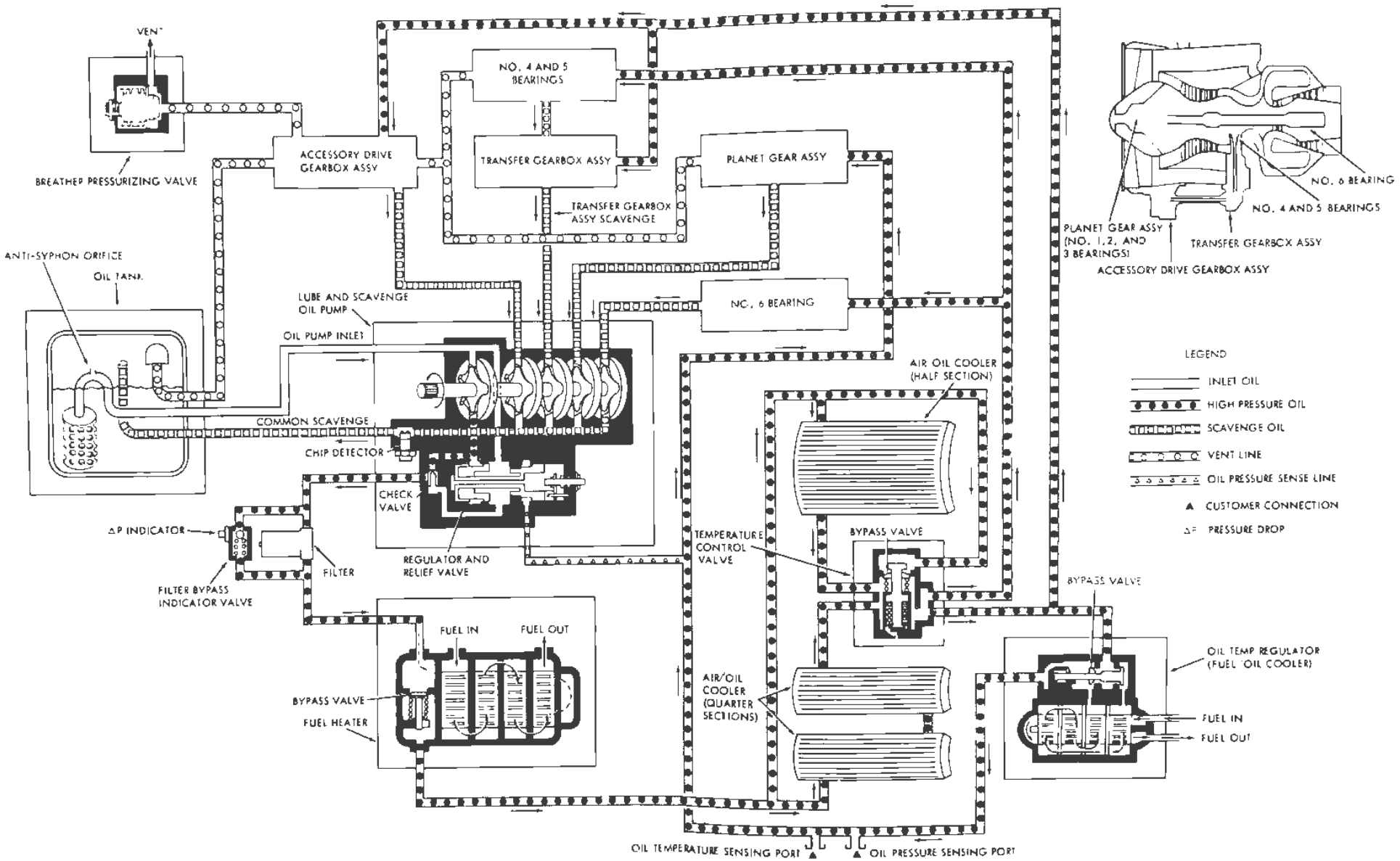
The anti-ice pressure switch provides a closed circuit for operation of a signal to the aircraft whenever the anti-icing system is operating.

13. Oil System

The engine oil supply is contained in the oil tank. Oil is drawn from the oil tank by the pressure pump element of the lube and scavenge oil pump, and supplied to filtering and temperature controlling components before routing for lubrication. A filter is provided to remove impurities from the oil. Engine protection against filter clogging is provided by an oil filter bypass indicator valve (delta P indicator and bypass valve) located adjacent to the oil filter. The valve opens when the pressure drop across the filter is excessive to bypass lubricating oil around the filter. An integral delta pressure indicator of the valve visually flags a clogged filter condition before bypassing occurs. A thermal lockout device on the delta P indicator prevents actuation under cold oil conditions although the bypass valve will bypass oil under these conditions. An oil temperature regulator (fuel/oil cooler) and three finned surface oil (air/oil) coolers provide temperature control of both fuel and oil. The fuel/oil cooler transfers heat from the lubricating oil to fuel circulated through the component. The finned air/oil coolers transfer heat from the lubricating oil to bypass air.

Oil flow through the fuel/oil cooler and the finned air/oil coolers is thermostatically controlled to provide optimum operating temperatures. Excess oil pressure with cold oil is prevented by bypass valves within the fuel/oil cooler and a temperature control valve installed with the air/oil coolers. (See figure 6.)

Pressurized oil is supplied by a pressure element of the lube and scavenge oil pump to the accessory drive and transfer gearbox assemblies, the planet gear assembly and high and low pressure shaft (number 3, 4, 5 and 6) bearings for lubrication. A four-element scavenge pump section of the oil pump returns the oil to the oil tank. Vent lines interconnect oil sumps to the oil tank and a breather pressurizing valve. The breather pressurizing valve provides an ambient vent for the oil system at low altitudes, and at high altitudes increases the internal engine vent and tank pressure to ensure proper oil pump operation.



Oil System Schematic
Figure 6

13. Oil System (Cont)

A fuel heater provides oil-to-oil heat exchanging to prevent ice formation in the fuel system from clogging the fuel filter and other components. Fuel flow through the fuel heater is thermostatically controlled by the anti-icing valve of the fuel pump. An oil pressure bypass valve prevents excessive pressure loss with cold oil.

14. Components and Accessories

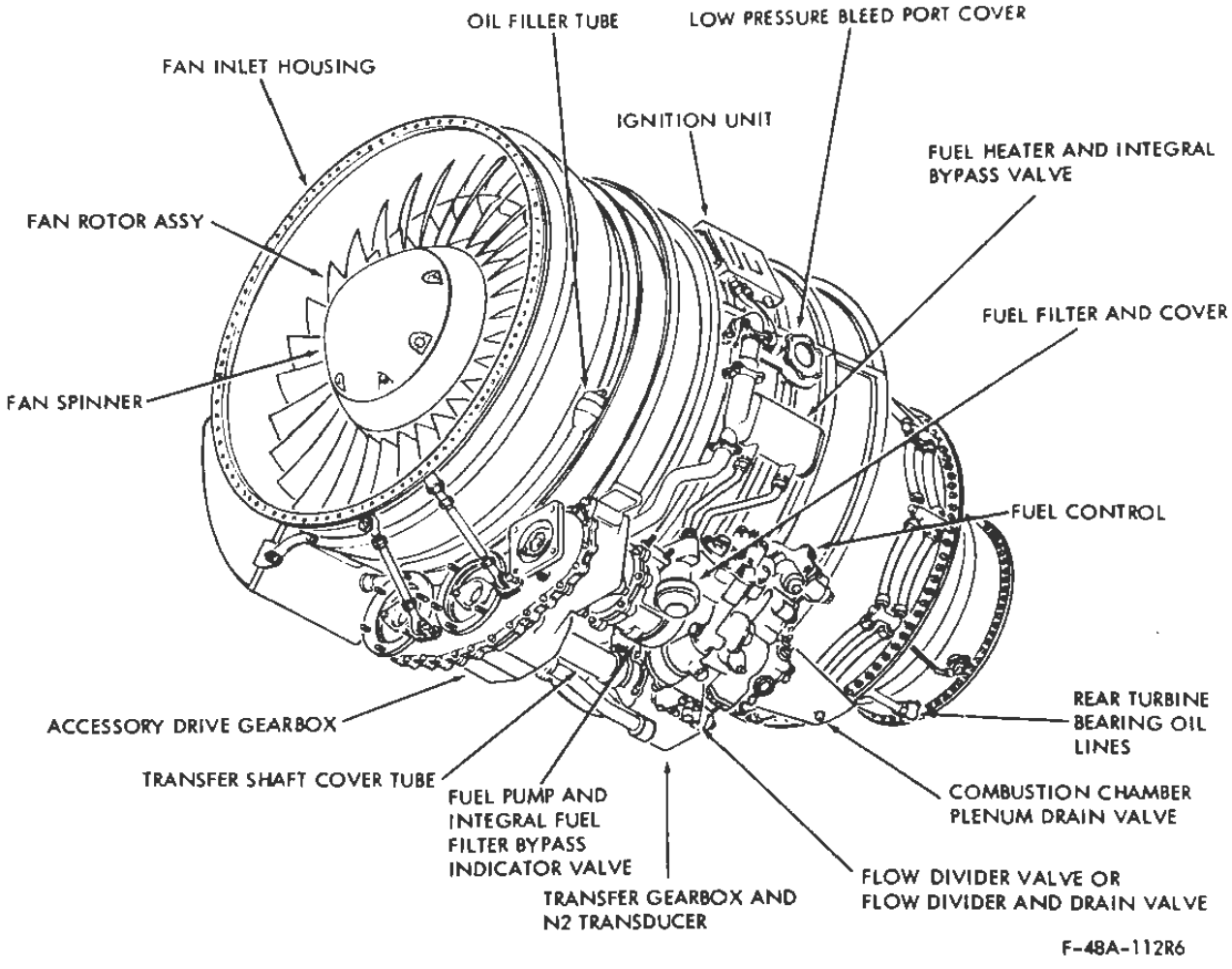
Engine components and accessories are mounted on the fan inlet housing, exhaust nozzle, fan duct assembly, accessory drive and transfer gearboxes, and combustion chamber plenum as shown in Figure 7.

15. Directional References

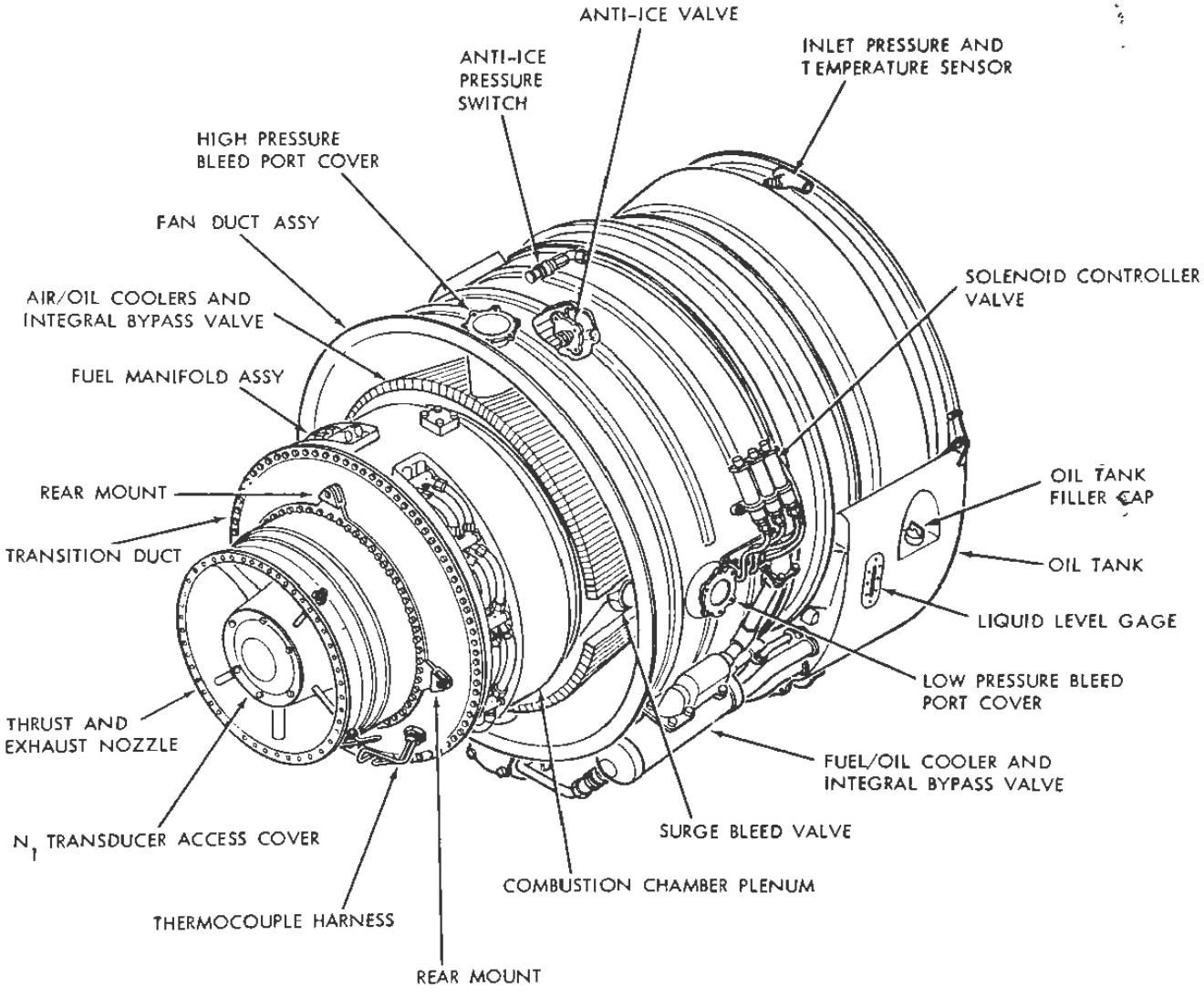
Directional references to front and rear, right and left, top and bottom, and clockwise and counterclockwise are made facing the turbine discharge duct with the engine in a horizontal position and the accessory drive gearbox downward.

16. Compressor Core

The internal section of the engine encompassing the low pressure and high pressure compressors consititues the compressor core of the engine.


OIL FILLER TUBE
LOW PRESSURE BLEED PORT COVER
FAN INLET HOUSING
IGNITION UNIT
FUEL HEATER AND INTEGRAL BYPASS VALVE
FAN ROTOR ASSY
FUEL FILTER AND COVER
FAN SPINNER
FUEL CONTROL
REAR TURBINE BEARING OIL LINES
ACCESSORY DRIVE GEARBOX
TRANSFER SHAFT COVER TUBE
FUEL PUMP AND INTEGRAL FUEL FILTER BYPASS INDICATOR VALVE
COMBUSTION CHAMBER PLENUM DRAIN VALVE
TRANSFER GEARBOX AND N2 TRANSDUCER
FLOW DIVIDER VALVE OR FLOW DIVIDER AND DRAIN VALVE
F-48A-112R6

Engine Components and Accessories (Typical)
Figure 7 (Sheet 1 of 2)



NOTE:
NOT SHOWN, ON AFT FACE OF ACCESSORY DRIVE GEARBOX:
OIL FILTER
OIL PUMP AND INTEGRAL PRESSURE REGULATOR
OIL FILTER BYPASS INDICATOR VALVE

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Engine Components and Accessories (Typical)
Figure 7 (Sheet 2)

CHAPTER 72 - GENERAL - TROUBLE SHOOTING

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1. Operational Trouble Shooting

WARNING: AREAS IN PROXIMITY OF ENGINE INLET AND EXHAUST ARE EXTREMELY HAZARDOUS TO PERSONNEL WHEN ENGINE IS OPERATING. PERSONNEL SHALL CLEAR THESE AREAS DURING ENGINE START AND OPERATION TO AVOID INJURY.

A. General

The following trouble shooting information is provided as an aid in locating the most probable cause of a malfunction based on the symptoms it produces. Though primarily intended for use by maintenance personnel, it may help a pilot or other operator of the engine to give more meaningful information to maintenance personnel, thereby reducing the time required by field maintenance in locating and correcting the problem. Values given are as representative as possible. However, in all cases, the Aircraft Flight Manual is to be used as a basis for operating, adjusting and evaluating the performance of the engine installed in the aircraft.

B. Trouble Shooting Guide

The trouble shooting guide is based on the indications which the engine displays to the operator, as well as procedures given in the Aircraft Flight Manual for starting and operating the engine. The malfunctions covered in this guide are arranged in the order in which they would appear if the operator followed a normal engine operating schedule. A normal engine operating schedule includes starting, acceleration, operation at engine takeoff speed, deceleration, and shutdown. Proper operation is depicted by the OK condition path in Tables 101 through 104. If malfunctions do occur, the procedure numbers at the right in the Fault Isolation Tables indicate the recommended trouble shooting procedure to follow. If malfunctions occur and the trouble shooting procedure is within the scope of this publication (special tools or test equipment not required) the procedure numbers listed in the Trouble Shooting Procedure columns in the Fault Isolation Tables indicates the recommended trouble shooting procedure to follow. If malfunctions occur and the trouble shooting procedure is beyond the scope of this publication (special tools or test equipment required) the procedure number listed in the LMM Trouble Shooting Procedure columns in the Fault Isolation Tables indicates the recommended trouble shooting procedure to follow in Light Maintenance Manual, Chapter/Section/Subject 72-00-00, GENERAL - TROUBLE SHOOTING. If a trouble shooting procedure is only partially within the scope of this publication the probable causes and remedies are listed for the portion of the procedure, then reference is listed to the Light Maintenance Manual for further trouble shooting. Trouble Shooting Procedure Numbers listed in this publication for procedures are the same Trouble Shooting Procedure Numbers listed in the Light Maintenance Manual for the corresponding procedures. Each trouble shooting procedure lists the probable causes and remedies for that problem. After performing the specified remedy, repeat the step at which the failure was encounterd and complete the test to check out the system.

1. B. Trouble Shooting Guide (Cont)

There is not deliberate duplication of problems, since it is assumed that the operator would have discovered such a problem during starting and would have initiated corrective action before proceeding with the checks. However, if a malfunction would not appear as a symptom until the aircraft were in flight or landing, etc, then the symptoms for this malfunction appear in the appropriate section. Therefore, when the user of this guide fails to find a set of symptoms under a later section of the guide, he is advised to start at the beginning of a routine check run or flight and see whether he has failed to recognize some significant symptoms earlier. When no tolerances are included on test values given within the trouble shooting procedures, values listed are approximate. All trouble shooting procedures are based on the assumption that applicable controls, electrical circuit breakers, and switches are positioned properly.

Troubles due to defective customer instrumentation and installation are not included in the table, except those directly involved with engine operation. Where this is a possibility, reference is appropriately made to the Aircraft Maintenance Manual.

C. Trouble Shooting Tips

(1) Indications shown in Tables 101 through 104 are provided by the following aircraft indicators.

(a) Engine battery dc voltmeter (customer-furnished).

NOTE: The electronic computer requires 15 to 32 volts dc for normal (automatic) mode of operation. The aircraft manual mode lamp may flicker with excessively low voltage supplied to electronic computer, such as when starting engine using aircraft batteries.

On normal start, the voltage will drop and slowly rise as rpm increases. A minor drop could be caused by starter rotation without engagement. Voltage will rise suddenly to normal at starter cut-out.

(b) Interstage turbine temperature (ITT) indicator (customer-furnished).

(c) Rpm indicators (customer-furnished). Two indicators provide readings. N1 (low pressure spool speed) and N2 (high pressure spool speed).

1. C. (1) (d) Fuel flow indicator (customer-furnished).

(e) Fuel pressure indicator (customer-furnished). Monitors aircraft low pressure fuel boost pump pressure.

(f) Oil pressure indicator (customer-furnished). Indicates planet gear assembly oil inlet pressure.

(g) Oil temperature indicator.

Oil temperature should rise to operating temperature, which will vary with ambient operating temperature (lower with lower temperature).

(2) Starting time should not exceed 50 seconds.

D. Prepare for Trouble Shooting

(1) Make exterior inspection on each engine.

(a) Engine air inlet and area - CLEAR AND CLEAN.

(b) Fan blades - GENERAL CONDITION.

(c) Engine exhaust and area - CLEAR.

(d) Rear turbine blades - GENERAL CONDITION.

(e) Engine cowling - SECURE.

WARNING: WHEN SERVICING OIL SYSTEM, CAUTION SHOULD BE EXERCISED TO AVOID CONTACT WITH HOT OIL WHICH MAY OVERFLOW FROM THE TANK DUE TO EXPANSION.

(f) Engine fuel and oil drains - CLEAR.

WARNING: INADVERTENT START COULD CAUSE INJURY TO PERSONNEL.

(2) Check that circuit breakers and switches are positioned as described in the Aircraft Maintenance Manual.

NOTE: Idle thrust in the manual mode may be higher than normal, but maximum thrust will be at least 80 percent of normal. On a cold day the flat rating of the engine will be exceeded at full power lever position. For large excesses in engine thrust, the P3 limiter mounted in the fuel control will protect the engine by reducing fuel flow in a cyclic manner. The fuel flow will continue to cycle until the power lever is retarded.

1. D. (3) An electronic computer caution light (manual mode lamp) is located on the cockpit instrument panel to indicate if the computer is operating or if the control system is operating in the manual mode. In the event of a transfer to the manual mode, the light will illuminate accompanied normally by a change in engine operating conditions. The action to be taken by the operator is as follows.

(a) Check that engine is operating within limits and reduce power as required to bring within limits.

(b) (Pre SB 76-3007) Cycle computer OFF/ON switch; if light remains ON no automatic overspeed protection is provided regardless of switch position.

(c) (Post SB 76-3007) Cycle computer OFF/ON switch; if light remains ON, leave switch in ON position and position NORMAL/MANUAL switch on the face of the electronic computer to MANUAL to maintain automatic low (N1) and high (N2) pressure spool overspeed protection.

(d) With the computer in manual mode, the operation of the engine is mechanically controlled by the operator. Care should be taken not to exceed engine limitations. Full engine power may not be available in the manual mode.

CAUTION: DO NOT DISCONNECT THE ELECTRONIC COMPUTER UNTIL ELECTRICAL POWER HAS BEEN CUT OFF. WHEN USING A SUBSTITUTE COMPUTER, THE ENGINE SHOULD BE OPERATED AS IF IT WERE IN THE MANUAL MODE (i.e., WATCHING ITT, MAXIMUM FLAT RATING, AND SPEED TO PREVENT EXCEEDING LIMITS) UNTIL COMPUTER HAS BEEN ADJUSTED IN ACCORDANCE WITH 72-00-00, GENERAL - ADJUSTMENT/TEST.

(e) Since the computer or a component of the control system may be faulty, follow the procedures recommended in the trouble shooting guide to isolate the faulty component.

Table 101. Engine Starting -0 Thru Idle RPM

OK CONDITION PATH		POWER LEVER SETTING	N_2 ACCEL RATE	N_2 % RPM	N_1 % RPM	ITT	FUEL FLOW PPH	OIL PRESS PSIG	OIL TEMP	TROUBLE SHOOTING PROCEDURE	*UMM TROUBLE SHOOTING PROCEDURE
TURN ON COMPUTER	NORMAL ⇨	MOVE TO IDLE AT 10% N_2	TO 40% WITHIN 30 SEC	INCREASE THRU APPROX 40	INCREASE THRU 20	AMBIENT TO 857°C (1575°F)	0 TO 250	0 TO 46	60°C (140°F) TO 113°C (235°F)		
OK	ELEK COMP DOES NOT REMAIN IN NORMAL MODE	—	—	—	—	—	—	—	—	——	1 OR 1A
INITIATE START - OBSERVE OR LISTEN FOR N_2 SPEED INCREASE	NO CRANKING - STARTER DOES NOT ENERGIZE		—	ZERO	ZERO	AMBIENT	ZERO	ZERO	ZERO	2	—
OK	NO CRANKING - STARTER ENERGIZES		—	ZERO	ZERO	AMBIENT	ZERO	ZERO	ZERO	——	3
	ENGINE CRANKS WITH STARTER ENERGIZED - NO N_2 RPM INDICATION		—	ZERO	ZERO	AMBIENT	ZERO	RISING NORMALLY	LOW	4	—
AT 10% N_2 MOVE POWER LEVER TO IDLE											
OK	ENGINE CRANKS ABOVE 14% N_2 - ITT DOES NOT RISE NO AUDIBLE IGNITION SNAP - FUEL PRESSURE AND FUEL FLOW INDICATIONS NORMAL	IDLE	—	ABOVE 14	LESS THAN 10	AMBIENT	NORMAL	RISING NORMALLY	LOW	5	—
	ENGINE CRANKS ABOVE 14% N_2 - ITT DOES NOT RISE - AUDIBLE IGNITION SNAP - NO OR LOW FUEL PRESSURE AND FUEL FLOW INDICATIONS	IDLE	—	ABOVE 14	LESS THAN 10	AMBIENT	BELOW NORMAL	RISING NORMALLY	LOW	6	—
	ENGINE CRANKS ABOVE 14% N_2 - ITT DOES NOT RISE - AUDIBLE IGNITION SNAP - NORMAL FUEL PRESSURE INDICATION - NO OR LOW FUEL FLOW INDICATION	IDLE	—	ABOVE 14	LESS THAN 10	AMBIENT	BELOW NORMAL	RISING NORMALLY	LOW	7	—
	ENGINE CRANKS ABOVE 14% N_2- ITT DOES NOT RISE - AUDIBLE IGNITION SNAP- NORMAL FUEL PRESSURE AND FUEL FLOW INDICATION	IDLE	—	ABOVE 14	LESS THAN 10	AMBIENT	NORMAL	RISING NORMALLY	LOW	——	8
OBSERVE THAT ENGINE CONTINUES TO ACCEL. TO IDLE. NOTE: STARTER AND IGNITION CUT OUT AT 50% N_2	ENGINE LIGHTS OFF AND ACCELERATES BUT NO ITT INDICATION	IDLE	NORMAL	ABOVE 17 & INCREASING	ABOVE 5 & INCREASING	NOT RISING	NORMAL	RISING NORMALLY	LOW	9	—
OK	LOW OIL PRESSURE	IDLE	NORMAL	40	20	RISING	ABOVE 100	NOT RISING	RISING	10	—
	NO N_1 INDICATION	IDLE	NORMAL	40	ZERO	RISING	ABOVE 100 & RISING	RISING	RISING	11	—

* PROCEDURE REQUIRES SPECIAL TOOLS OR TEST EQUIPMENT, REFER TO LIGHT MAINTENANCE MANUAL FOR TROUBLE SHOOTING AND REPAIR.

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Table 101. Engine Starting -0 Thru Idle RPM (Cont)

OK CONDITION PATH			POWER LEVER SETTING	N_2		N_1 % RPM	ITT	FUEL FLOW PPH	OIL PRESS PSIG	OIL TEMP	TROUBLE SHOOTING PROCEDURE	* LAM TROUBLE SHOOTING PROCEDURE
				ACCEL RATE	% RPM							
OK	NOT OK	HUNG START - MANUAL SHUTDOWN	IDLE	SLOW	BELOW 50	BELOW 10	NORMAL	NOT RISING	STEADY	RISING	12	———
	NOT OK	HOT START - MANUAL SHUTDOWN	IDLE	NORMAL	BELOW 50	BELOW 10	HIGH & RISING	HIGH	RISING	RISING	13	———
	NOT OK	ENGINE LIGHTS-OFF BUT SHUTS DOWN DURING ACCELERATION TO IDLE	IDLE	—	INCR NORM THEN DECREASE	INCR NORM THEN DECREASE	NORMAL	LOW	RISING	RISING	14	———
	NOT OK	ENGINE ACCELERATES SLOWLY OR NOT AT ALL (NORMAL ITT)	IDLE	SLOW	ABOVE 50	ABOVE 10	NORMAL	LOW	RISING NORMALLY	RISING NORMALLY	15	———
	NOT OK	ENGINE ACCELERATES SLOWLY OR NOT AT ALL (ITT OR FUEL FLOW HIGH)	IDLE	SLOW	ABOVE 50	ABOVE 10	HIGH	HIGH	RISING NORMALLY	RISING NORMALLY	———	16
ENGINE START SYSTEM IS NORMAL	NOT OK	ENGINE CONTINUES TO ACCEL ABOVE IDLE WITH POWER LEVER IN IDLE	IDLE	NORMAL	INCREASING ABOVE 50	INCREASING ABOVE 24	INCREAS'G	INCREASING	RISING NORMALLY	RISING NORMAL.	17	———

* PROCEDURE REQUIRES SPECIAL TOOLS OR TEST EQUIPMENT, REFER TO LIGHT MAINTENANCE MANUAL FOR TROUBLE SHOOTING AND REPAIR.

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Table 102. Engine Acceleration to Take-Off

OK CONDITION PATH		POWER LEVER SETTING	N_2 ACCEL. RATE	N_2 %RPM	N_1 %RPM	ITT	FUEL FLOW PPH	OIL PRESS. PSIG	T TEMP	TROUBLE SHOOTING PROCEDURE	*LIMIT TROUBLE SHOOTING PROCEDURE
	NORMAL ⇨	MOVE TO TAKE-OFF				APPROX 538°C (1000°F) TO 857°C(1575°F	700 TO 2400	38 TO 46	60°C (140°F TO 113°C (235°F		
MOVE POWER LEVER TO TAKE-OFF OBSERVE ACCEL											
OK ↓ NOT OK	ITT HIGH DURING ACCELERATION FROM IDLE	TAKE-OFF	NORMAL	INCREASING ABOVE IDLE	INCREASING ABOVE IDLE	ABOVE NORMAL	HIGH	RISING NORMALLY	RISING NORMALLY	1E	—
NOT OK	ENGINE SURGES DURING ACCELERATION	TAKE-OFF	ABNORMAL	ERRATIC	ERRATIC	ERRATIC	ERRATIC	RISING NORMALLY	RISING NORMALLY	1F	—
ENGINE OPERATING AT TAKE OFF 100% N_2, 90% N_1											
NOT OK	LOW THRUST	TAKE-OFF	—	MAX	LESS THAN NORMAL	BELOW OR ABOVE NORMAL		NORMAL	NORMAL	2C	—
NOT OK	LOW N_1 AND FUEL FLOW INITIALLY, THEN RETURNING TO NORMAL	TAKE-OFF	—	MAX	LOW THEN NORMAL	NORMAL OR ABOVE NORMAL	LOW THEN NORMAL	NORMAL	NORMAL	—	2T
NOT OK	ENGINE OVERSPEEDS	TAKE-OFF	ACCEL-ERATING	ABOVE MAX OR	ABOVE MAX	ABOVE NORMAL	ABOVE NORMAL	NORMAL	NORMAL	—	2E
NOT OK	NO N_2 INDICATION	TAKE-OFF	—	ZERO	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	23	—
OK ↓ NOT OK	NO N_1 INDICATION	TAKE-OFF	—	NORMAL	ZERO	NORMAL	NORMAL	NORMAL	NORMAL	24	—
NOT OK	NO ITT INDICATION	TAKE-OFF	—	NORMAL	NORMAL	—	NORMAL	NORMAL	NORMAL	25	—
NOT OK	N_1, N_2, AND ITT ERRATIC	TAKE-OFF	—	ERRATIC	ERRATIC	ERRATIC	ERRATIC	NORMAL	NORMAL	—	2E
NOT OK	ITT HIGH	TAKE-OFF	—	LOW OR MAX	LOW OR MAX	HIGH	NORMAL	NORMAL	NORMAL	2F	—
NOT OK	OIL CONSUMPTION EXCESSIVE	TAKE-OFF	—	MAX	MAX	NORMAL	NORMAL	NORMAL	NORMAL	—	2S
NOT OK	(PRE SB72-3085) OIL FUMES IN BLEED AIR OR DISCHARGING FROM BRTHR, PRESS. VALVE	TAKE-OFF	—	MAX	MAX	NORMAL	NORMAL	NORMAL	NORMAL	—	2S

*PROCEDURE REQUIRES SPECIAL TOOLS OR TEST EQUIPMENT, REFER TO LIGHT MAINTENANCE MANUAL FOR TROUBLE SHOOTING AND REPAIR.

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Table 102. Engine Acceleration to Take-Off (Cont)

OK CONDITION PATH		POWER LEVER SETTING	N_2 ACCEL. RATE	N_2 %RPM	N_1 %RPM	ITT	FUEL FLOW PPH	OIL PRESS. PSIG	OIL TEMP	TROUBLE SHOOTING PROCEDURE	*LMM TROUBLE SHOOTING PROCEDURE
OK	NOT OK (POST SB72-3085) OIL FUMES IN BLEED AIR OR DISCHARGING FROM BRTHR. PRESS. VALVE	TAKE-OFF	—	MAX	MAX	NORMAL	NORMAL	NORMAL	NORMAL	—	29A
	NOT OK LOW OIL PRESS AT ALTITUDE (NORMAL ON GND)	FLIGHT RQMT	—	FLIGHT RQMT	FLIGHT RQMT	NORMAL	NORMAL	LOW	NORMAL	—	30
	NOT OK HIGH OIL TEMP	TAKE-OFF	—	MAX	MAX	NORMAL	NORMAL	LOW OR NORMAL	HIGH	31	—
	NOT OK HIGH OIL PRESS	TAKE-OFF	—	MAX	MAX	NORMAL	NORMAL	HIGH	NORMAL	32	—
	NOT OK (PRE SB72-3085) NO ENGINE ANTI-ICE INDICATION	TAKE-OFF	—	MAX	MAX	NORMAL	NORMAL	NORMAL	NORMAL	33	—
ENGINE NORMAL AT TAKE-OFF											

*PROCEDURE REQUIRES SPECIAL TOOLS OR TEST EQUIPMENT, REFER TO LIGHT MAINTENANCE MANUAL FOR TROUBLE SHOOTING AND REPAIR.

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Table 103. Engine Deceleration to Idle

OK CONDITION PATH		POWER LEVER SETTING	N_2 ACCEL. RATE	N_2 % RPM	N_1 % RPM	ITT	FUEL FLOW PPH	OIL PRESS. PSIG	OIL TEMP.	TROUBLE SHOOTING PROCEDURE	*LMM TROUBLE SHOOTING PROCEDURE
	NORMAL ⇨	AT TAKEOFF				APPROX 538° C (1000° F) TO 857° C(1575° F)	200 TO 2400	38 TO 46	60° C (140° F)TO 113° C (235° F)		
MOVE POWER LEVER TO IDLE											
NOT OK	ENGINE FLAMES OUT WHEN POWER LEVER RETARDED	RETARDED	FAST DECEL	DECREASING	DECREASING	DECREASING	NORMAL OR LOW	NORMAL	NORMAL	——	34
NOT OK	ENGINE DECELERATION SLOW	IDLE	SLOW DECEL	ABOVE NORMAL	ABOVE NORMAL	ABOVE NORMAL	ABOVE NORMAL	NORMAL	NORMAL	35	——
NOT OK	ENGINE SURGES DURING DECELERATION	IDLE	ABNORMAL DECEL	ERRATIC	ERRATIC	ERRATIC	ERRATIC	NORMAL	NORMAL	36	——
OK ⇩											
ENGINE NORMAL AT IDLE											

*PROCEDURE REQUIRES SPECIAL TOOLS OR TEST EQUIPMENT, REFER TO LIGHT MAINTENANCE MANUAL FOR TROUBLE SHOOTING AND REPAIR.

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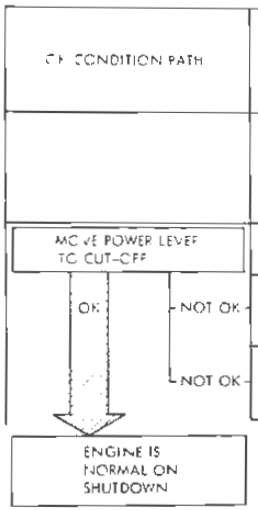
Table 104. Engine Cut-off



CP CONDITION PATH		POWER LEVER SETTING	N_2 DECEL RATE	N_2 % RPM	N_1 % RPM	ITT	FUEL FLOW PPH	OIL PRESS PSIG	OIL TEMP	*TROUBLE SHOOTING PROCEDURE	* LMM TROUBLE SHOOTING PROCEDURE
	NORMAL ⇨	CUT-OFF	MORE THAN 30 SEC	58 TO 0	DECREASE 25 TO 0	APPROX 538°C (1000°F) TO 204°C (400°F)	250 TO 0	46 TO 0	90°C (140°F) TO 113°C (235°F)		
MOVE POWER LEVER TO CUT-OFF											
NOT OK	ENGINE DOES NOT SHUTDOWN	CUT-OFF	NO DECEL	58	25	NORMAL	NORMAL	NORMAL	NORMAL	37	——
NOT OK	ENGINE ROLLDOWN AFTER SHUTDOWN IS ABNORMAL	CUT-OFF	——	ZERO	ZERO	——	——	——	——	——	38

* PROCEDURE REQUIRES SPECIAL TOOLS OR TEST EQUIPMENT, REFER TO LIGHT MAINTENANCE MANUAL FOR TROUBLE SHOOTING AND REPAIR.

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PROCEDURE 2

PROBLEM: No cranking - starter does not energize.

PROBABLE CAUSE:
1. Aircraft battery may be weak or dead.
2. Starter control circuit may be faulty.
3. Starter may be faulty.

REMEDY:
1. Check battery in accordance with Aircraft Maintenance Manual.
2. Check starter control circuit in accordance with Aircraft Maintenance Manual.
3. Check starter in accordance with Aircraft Maintenance Manual.

PROCEDURE 4

PROBLEM: Engine cranks with starter energized - No N2 RPM indication.

PROBABLE CAUSE:
1. Aircraft N2 indicating system may be faulty.

REMEDY:
1. Check aircraft N2 indicating system in accordance with Aircraft Maintenance Manual.
2. Refer to Light Maintenance Manual, Chapter/Section/Subject 72-00-00, GENERAL - TROUBLE SHOOTING for additional trouble shooting.

PROCEDURE 5

PROBLEM: Engine cranks above 14 percent N2 - ITT does not rise - No audible ignition snap - Fuel pressure and fuel flow indications normal.

PROBABLE CAUSE:
1. Aircraft ignition circuit may be faulty.
2. Engine ignition system faulty.

REMEDY:
1. Check aircraft ignition system in accordance with Aircraft Maintenance Manual.
2. Perform Ignition System Check. Refer to INSPECTION/CHECK.

PROCEDURE 6

PROBLEM: Engine cranks above 14 percent N2 - ITT does not rise - Audible ignition snap - No or low fuel pressure and fuel flow indications.

PROBABLE CAUSE:
1. Aircraft fuel boost pump or fuel boost pump electrical circuit may be faulty.
2. Aircraft fuel shutoff valve or fuel shutoff valve control may be faulty.

REMEDY:
1. Check fuel boost pump and fuel boost pump electrical circuit in accordance with Aircraft Maintenance Manual.
2. Check fuel shutoff valve and fuel shutoff valve control in accordance with Aircraft Maintenance Manual.

PROCEDURE 7

PROBLEM: Engine cranks above 14 percent N2 - ITT does not rise - Audible ignition snap - Normal fuel pressure indication - No or low fuel flow indication.

PROBABLE CAUSE:
1. (Pre SB 76-3007) Aircraft fuel enrich (SPR) circuit may be faulty.

REMEDY:
1. Check fuel flow in manual mode. If fuel flow is normal, check aircraft fuel enrich circuit in accordance with Aircraft Maintenance Manual.
2. Refer to Light Maintenance Manual, Chapter/Section/Subject 72-00-00, GENERAL - TROUBLE SHOOTING for additional trouble shooting.

PROCEDURE 9

PROBLEM: Engine lights off and accelerates but no ITT indication.

PROBABLE CAUSE:
1. ITT indicator may be defective.
2. Aircraft circuit between ITT indicator and ITT thermocouple harness may be faulty.
3. ITT thermocouple harness electrical connector contaminated.

REMEDY:
1. Check ITT indicator in accordance with Aircraft Maintenance Manual.
2. Check aircraft electrical circuit between ITT indicator and ITT thermocouple harness for contaminated connectors and other faults in accordance with Aircraft Flight Manual.
3. Check ITT thermocouple harness electrical connector for contamination.
4. Refer to Light Maintenance Manual, Chapter/Section/Subject 72-00-00, GENERAL - TROUBLE SHOOTING for additional trouble shooting.

PROCEDURE 10

PROBLEM: Low oil pressure.

PROBABLE CAUSE:
1. Low oil supply.
2. High oil temperature.
3. Clogged oil filter.
4. Oil system leak.
5. Aircraft oil pressure indicating system faulty.
6. Oil pump pressure regulator setting incorrect.

REMEDY:
1. Check oil level and if low, replenish with approved engine oil. Refer to SERVICING.
2. High oil temperature could cause low oil pressure. Refer to PROCEDURE 31.
3. Check for extended red pin on oil filter bypass valve on accessory drive gearbox (figure 602) If extended, inspect oil filter and chip detector. Refer to INSPECTION/CHECK.
4. Tighten, repair, or replace leaking component.
5. Check aircraft oil pressure indicating system in accordance with Aircraft Maintenance Manual.
6. Adjust oil pump pressure regulator. Refer to ADJUSTMENT/TEST.

PROCEDURE 11

PROBLEM: No N1 indication.

PROBABLE CAUSE:
1. Aircraft N1 indication system may be faulty.

REMEDY:
1. Check aircraft N1 indicating system in accordance with Aircraft Maintenance Manual.
2. Refer to Light Maintenance Manual, Chapter/Section/Subject 72-00-00, GENERAL - TROUBLE SHOOTING for additional trouble shooting.

PROCEDURE 12

PROBLEM: Hung start (No or slow acceleration during start) - Manual shutdown.

PROBABLE CAUSE:
1. Weak battery.

REMEDY:
1. Check battery in accordance with Aircraft Maintenance Manual.
2. Refer to Light Maintenance Manual, Chapter/Section/Subject 72-00-00, GENERAL - TROUBLE SHOOTING for additional trouble shooting.

PROCEDURE 13

PROBLEM: Hot start - Observe overtemperature limits in Aircraft Flight Manual - (N1 spool accelerates normally) - If exceeded, shutdown engine.

PROBABLE CAUSE:

1. Electronic computer in manual mode.
2. Aircraft air conditioning bleed air valve not functioning properly.
3. Combustion chamber plenum drain valve(s) plugged.
4. Aircraft ITT indicating system may be faulty.
5. Fuel control torque motor electrical connector loose.

REMEDY:

1. Check manual mode indicator light - If on, refer to Light Maintenance Manual, Chapter/Section/Subject 72-00-00, GENERAL - INSPECTION/CHECK, PROCEDURE 1.
2. Check aircraft air conditioning bleed air valve for proper operation in accordance with Aircraft Maintenance Manual.
3. Remove obstruction from combustion chamber plenum drain valve. (See figure 7.)
4. Check aircraft ITT indicating system in accordance with Aircraft Maintenance Manual.
5. Tighten torque motor electrical connector on fuel control.
6. Refer to Light Maintenance Manual, Chapter/Section/Subject 72-00-00, GENERAL - TROUBLE SHOOTING for additional trouble shooting.

PROCEDURE 14

PROBLEM: Engine lights off but shuts down during acceleration to idle.

PROBABLE CAUSE:
1. Air in fuel or low fuel supply.
2. Incorrect electronic computer fuel setting.

REMEDY:
1. Replenish fuel supply or bleed fuel system in accordance with Aircraft Maintenance Manual.
2. Perform Fuel Type Adjustment Procedure. Refer to ADJUSTMENT/TEST.
3. Refer to Light Maintenance Manual, Chapter/Section/Subject 72-00-00, GENERAL - TROUBLE SHOOTING for additional trouble shooting.

PROCEDURE 15

PROBLEM: Engine accelerates slowly or not at all. (Normal ITT).

PROBABLE CAUSE:
1. Incorrect electronic computer fuel setting.

REMEDY:
1. Perform Fuel Type Adjustment Procedure. Refer to ADJUSTMENT/TEST.
2. Refer to Light Maintenance Manual, Chapter/Section/Subject 72-00-00, GENERAL - TROUBLE SHOOTING for additional trouble shooting.

PROCEDURE 17

PROBLEM: Engine continues to accelerate above idle with power lever in idle position.

PROBABLE CAUSE:
1. Fuel control torque motor electrical connector loose.
2. Incorrect power lever rigging.

REMEDY:
1. Switch to manual mode and recheck. If engine does not continue to accelerate above idle with power lever in idle position, tighten torque motor electrical connector on fuel control.
2. If engine continues to accelerate above idle with power lever in idle position and operating in manual mode, adjust power lever rigging in accordance with Aircraft Maintenance Manual.
3. Refer to Light Maintenance Manual, Chapter/Section/Subject 72-00-00, GENERAL - TROUBLE SHOOTING for additional trouble shooting.

PROCEDURE 18

PROBLEM: ITT high during acceleration from idle.

PROBABLE CAUSE:
1. Aircraft system utilizing engine bleed air may be leaking.

REMEDY:
1. Check aircraft systems utilizing engine bleed air for leaks in accordance with Aircraft Maintenance Manual.
2. Refer to Light Maintenance Manual, Chapter/Section/Subject 72-00-00, GENERAL - TROUBLE SHOOTING for additional trouble shooting.

PROCEDURE 19

PROBLEM: Engine surges during acceleration.

PROBABLE CAUSE:
1. Incorrect electronic computer fuel setting.

REMEDY:
1. Switch to manual mode and recheck. If engine accelerates normally, perform Fuel Type Adjustment Procedure. Refer to ADJUSTMENT/TEST.
2. Refer to Light Maintenance Manual, Chapter/Section/Subject 72-00-00, GENERAL - TROUBLE SHOOTING for additional trouble shooting.

PROCEDURE 20

PROBLEM: Low thrust. Check ITT indication and manual mode indicator light.

PROBABLE CAUSE:

1. If ITT indication is below normal and manual mode indicator light is off, electronic computer Flat Rat/Max Speed setting may be incorrect.
2. Incorrect power lever rigging.
3. If ITT indication is above normal, aircraft system utilizing engine bleed air may be leaking.

REMEDY:

1. Perform Maximum Low Pressure Rotor Speed (N1) Adjustment Procedure. Refer to ADJUSTMENT/TEST.
2. Check power lever rigging in accordance with Aircraft Maintenance Manual.
3. Check aircraft systems utilizing engine bleed air for leaks in accordance with Aircraft Maintenance Manual.
4. Refer to Light Maintenance Manual, Chapter/Section/Subject 72-00-00, GENERAL - TROUBLE SHOOTING for additional trouble shooting.

PROCEDURE 23

PROBLEM: No N2 indication.

PROBABLE CAUSE:
1. Aircraft N2 indicating system may be faulty.

REMEDY:
1. Check aircraft N2 indicating system in accordance with Aircraft Maintenance Manual.
2. Refer to Light Maintenance Manual, Chapter/Section/Subject 72-00-00, GENERAL - TROUBLE SHOOTING for additional trouble shooting.

PROCEDURE 24

PROBLEM: No N1 indication.

PROBABLE CAUSE:
1. Aircraft N1 indicating system may be faulty.

REMEDY:
1. Check aircraft N1 indicating system in accordance with Aircraft Maintenance Manual.
2. Refer to Light Maintenance Manual, Chapter/Section/Subject 72-00-00, GENERAL - TROUBLE SHOOTING for additional trouble shooting.

PROCEDURE 25

PROBLEM: No ITT indication.

PROBABLE CAUSE:
1. Aircraft ITT indicating system may be faulty.
2. ITT thermocouple harness electrical connector contaminated.

REMEDY:
1. Check aircraft ITT indicating system in accordance with Aircraft Maintenance Manual.
2. Check ITT thermocouple harness electrical connectors for contamination.
3. Refer to Light Maintenance Manual, Chapter/Section/Subject 72-00-00, GENERAL - TROUBLE SHOOTING for additional trouble shooting.

PROCEDURE 27

PROBLEM: ITT high. Check N1 speed indication.

PROBABLE CAUSE:

1. If N1 speed is normal, aircraft ITT indicating system may be faulty.
2. If N1 speed is below normal, aircraft system utilizing engine bleed air may be leaking.

REMEDY:

1. Check ITT indicating system in accordance with aircraft Maintenance Manual.
2. Check aircraft systems utilizing engine bleed air for leaks in accordance with Aircraft Maintenance Manual.
3. Refer to Light Maintenance Manual, Chapter/Section/Subject 72-00-00, GENERAL - TROUBLE SHOOTING for additional trouble shooting.

PROCEDURE 31

PROBLEM: High oil temperature.

PROBABLE CAUSE:
1. Low oil supply.
2. Aircraft oil temperature indicating system may be faulty.
3. Low oil pressure.

REMEDY:
1. Check oil level and if low, replenish with approved engine oil. Refer to SERVICING.
2. Check aircraft oil temperature indicating system in accordance with Aircraft Maintenance Manual.
3. Check oil pressure, if low, perform PROCEDURE 10.
4. Refer to Light Maintenance Manual, Chapter/Section/Subject 72-00-00, GENERAL - TROUBLE SHOOTING for additional trouble shooting.

PROCEDURE 32

PROBLEM: High oil pressure.

PROBABLE CAUSE:
1. Aircraft oil pressure indicating system may be faulty.
2. Oil pump pressure regulator setting incorrect.

REMEDY:
1. Check oil pressure indicating system in accordance with Aircraft Maintenance Manual.
2. Adjust oil pump pressure regulator. Refer to ADJUSTMENT/TEST.
3. Refer to Light Maintenance Manual, Chapter/Section/Subject 72-00-00, GENERAL - TROUBLE SHOOTING for additional trouble shooting.

PROCEDURE 33

PROBLEM: (Pre SB 72-3085) No engine anti-ice indication.

PROBABLE CAUSE:
1. Aircraft anti-ice power circuit may be faulty.

REMEDY:
1. Check aircraft anti-ice power circuit in accordance with Aircraft Maintenance Manual.
2. Refer to Light Maintenance Manual, Chapter/Section/Subject 72-00-00, GENERAL - TROUBLE SHOOTING for additional trouble shooting.

PROCEDURE 35

PROBLEM: Engine deceleration slow.

PROBABLE CAUSE:
1. Incorrect electronic computer fuel setting.
2. Aircraft pressure line between inlet pressure and temperature sensor and electronic computer may be leaking.

REMEDY:
1. Perform Fuel Type Adjustment Procedure. Refer to ADJUSTMENT/TEST.
2. Check aircraft pressure line between inlet pressure and temoerature sensor and electronic computer for leak in accordance with Aircraft Maintenance Manual.
3. Refer to Light Maintenance Manual, Chapter/Section/Subject 72-00-00, GENERAL - TROUBLE SHOOTING for additional trouble shooting.

PROCEDURE 36

PROBLEM: Engine surge during deceleration.

PROBABLE CAUSE:
1. Incorrect electronic computer fuel setting.

REMEDY:
1. Perform Fuel Type Adjustment Procedure. Refer to ADJUSTMENT/TEST.
2. Refer to Light Maintenance Manual, Chapter/Section/Subject 72-00-00, GENERAL - TROUBLE SHOOTING for additional trouble shooting.

PROCEDURE 37

PROBLEM: Engine does not shut down.

PROBABLE CAUSE:
1. Aircraft power lever linkage on fuel control may be loose.
2. Incorrect aircraft power lever rigging.

REMEDY:
1. Check for loose aircraft power lever linkage on fuel control in accordance with Aircraft Maintenance Manual.
2. Check power lever rigging in accordance with Aircraft Maintenance Manual.
3. Refer to Light Maintenance Manual, Chapter/Section/Subject 72-00-00, GENERAL - TROUBLE SHOOTING for additional trouble shooting.

CHAPTER 72 - SERVICING

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GENERAL - SERVICING

1. General

This section contains engine servicing requirements and procedures. Table 301 lists approved engine lubricating oils. Table 302 lists materials and compounds for servicing other than oil system servicing.

Table 301. Approved Engine Oils

Oil Brand and Trade Name
Mobil Jet Oil II (Type II)
Exxon/Esso 2380 Turbo Oil (Type II)
Castrol 5000 (Type II)

NOTE: Oil is to be changed at each 500 hours of operation. The listed brands of approved oil may be mixed. Other types of oil are not approved. Refer to Aircraft Flight Manual for specific lubricant to be used.

Table 302. Materials and Compounds

Material or Compound	Manufacturer
NOTE: Equivalent substitutes may be used for listed items.	
Grease (Aeroshell 17) (MIL-G-21164)	Shell Oil Co, 50 W 50th St, New York, NY 10020
Grease (Aeroshell 22) (MIL-G-81322)	Shell Oil Co, 50 W 50th St, New York, NY 10020
Grease (MIL-G-21164)	Commercially available
Grease (Mobil Grease No. 28) (MIL-G-81322)	Mobil Chemical Co, Chemical Coatings Div, 150 E 42nd St, New York, NY 10017
Grease (Mobil Grease No. 29 (Molybdenum-Disulphide) (MIL-G-81827)	Mobil Chemical Co, Chemical Coatings Div, 150 E 42nd St, New York, NY 10017

2. Oil System Servicing Requirements

A. Requirements for Checking Oil Level

(1) Each post-flight inspection.

(2) As procedural step of any engine maintenance.

B. Requirements for Performing Spectrographic Oil Analysis (SOAP) (9, INSPECTION/CHECK) check.

NOTE: SOAP has proved to be effective at other than the intervals recommended in diagnosing engine problems. Therefore, it is recommended an oil sample (with oil filter) be submitted for analysis when an intermittent or change in engine operating parameter occurs. Example: fluctuating oil pressure, change in audible noise level, etc.

(1) Each 150 hours of engine operation.

(2) When metal particles are evident on magnetic plug.

(3) When oil filter bypass valve indicator pin is in extended position.

(4) When metal particles are evident in drained engine oil.

(5) When metal particles are evident on removed oil filter.

(6) After 25 hours of operation following any of the following maintenance procedures. (To establish baseline for subsequent SOAP checks).

(a) Oil fill after initial engine installation.

(b) Each oil change.

(c) Replacement of planet gear assembly, planet gearshaft, pinion gearshaft, or ring gear.

C. Requirements for Changing Oil

After each 500 hours of engine operation.

3. Oil Changing

A. Oil Changing Instructions

(1) Drain oil system in accordance with 4.

(2) Fill oil system in accordance with 6.

4. Oil System Draining

NOTE: If possible, oil shall be drained while the engine is still warm from operation.

A. Oil Tank Draining

(1) Remove drain plug (105, figure 301), and discard packing (110). Allow oil to drain into suitable container.

(2) Install new packing (110) on drain plug (105), and install plug.

(3) Tighten plug to 120 to 130 inch-pounds torque and lockwire.

B. Accessory Drive Gearbox Draining

(1) Remove plug (5, figure 302), and discard packing (10). Allow oil to drain into suitable container.

(2) Install new packing (10) on plug (5), and install plug.

(3) Tighten plug to 160 inch-pounds.

NOTE: Before refilling oil system, replace oil filter element. Refer to 8, INSPECTION/CHECK.

5. Oil System Filling (Initial Engine Installation)

NOTE: Refer to 6, when filling oil system that has been drained subsequent to engine installation.

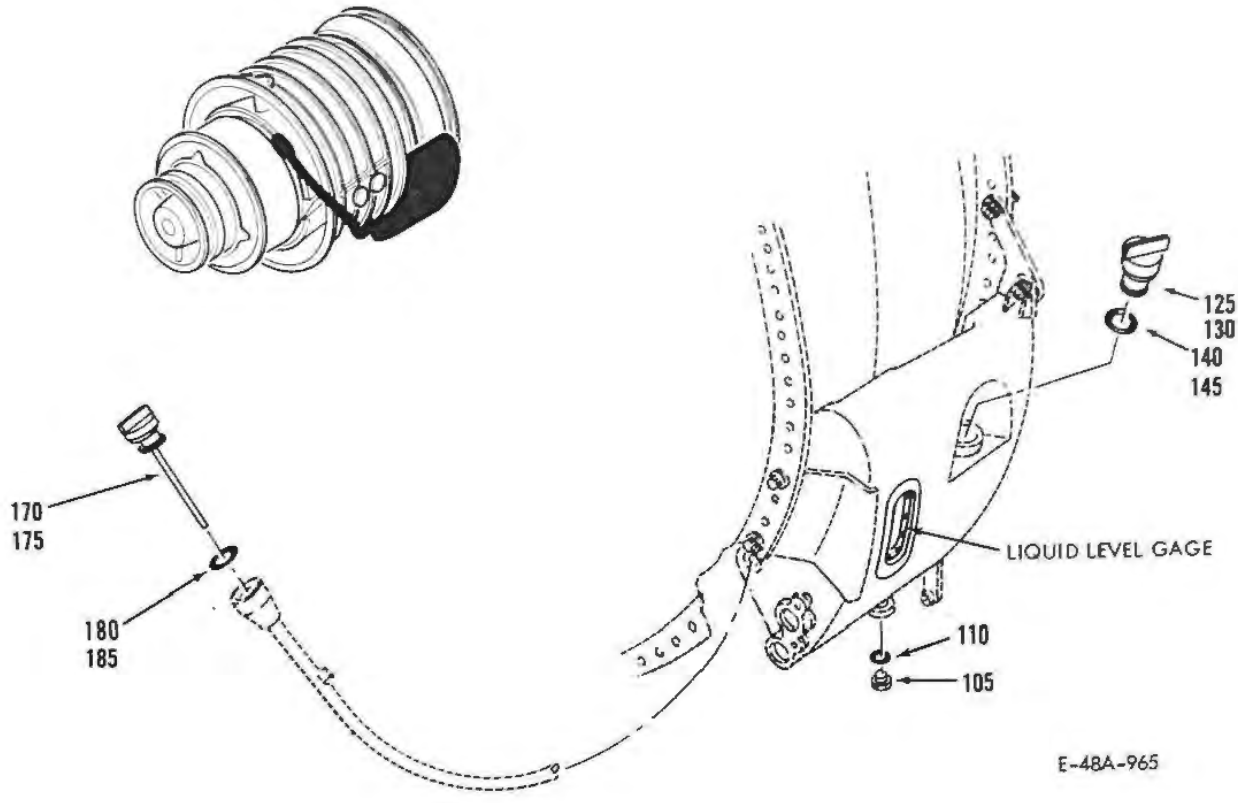
A. Fill Oil Tank

CAUTION: USE ONLY APPROVED OIL (TABLE 301).

(1) Remove filler plug (125 or 130, figure 301).

(2) Fill tank with oil until liquid level gage or gage (170 or 175) indicates full.

(3) Reinstall filler plug (125 or 130).

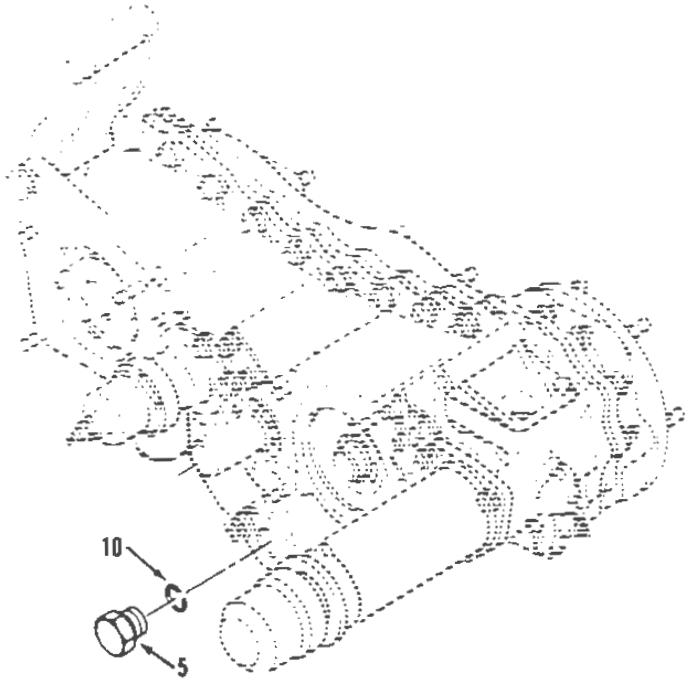


105. DRAIN PLUG (IPC FIG. 43)
110. PACKING (S9413-556)
125. FILLER PLUG (572-533-9103)
(VENDOR PART NO. B3990C)
130. FILLER PLUG (572-533-9201)
(VENDOR PART NO. B4129)
140. PACKING (S9413-020)
(COMPONENT OF ITEM 130)
145. PACKING (S9412-117)
(COMPONENT OF ITEM 130A)
170. GAGE (361-530-9003)
(VENDOR PART NO. B3960A)
(IPC FIGURE 42)

-170A. GAGE (361-530-9004)
(VENDOR PART NO. B3960C)
175. GAGE (361-530-9101)
(VENDOR PART NO. B4130)
180. PACKING (S9413-020)
(COMPONENT OF ITEMS
170/170A)
185. PACKING (S9413-117)
(COMPONENT OF ITEM 170B)

-ITEM NOT ILLUSTRATED

Oil Tank Filler and Drain Ports
Figure 301



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5. OIL DRAIN PLUG (IPC FIG. 60)

10. PACKING (S9413-557)

Accessory Drive Gearbox Drain Plug
Figure 302

5. B. Motor Engine

(1) Motor engine for 15 seconds.

(2) Top off oil tank in accordance with A.

C. Run Engine

WARNING: AREAS IN PROXIMITY OF ENGINE INLET AND EXHAUST ARE EXTREMELY HAZARDOUS TO PERSONNEL WHEN ENGINE IS OPERATING. PERSONNEL SHALL CLEAR THESE AREAS DURING ENGINE START AND OPERATION TO AVOID INJURY.

CAUTION: SHUT DOWN ENGINE IMMEDIATELY IF OIL PRESSURE IS NOT INDICATED WITHIN TEN SECONDS.

(1) Perform normal engine start and accelerate to idle speed in accordance with Aircraft Flight Manual.

(2) Run engine for at least five minutes, then perform normal engine shutdown.

D. Recheck Oil Level

(1) Recheck oil level in tank.

(2) If required, add oil in accordance with A.

6. Oil System Filling (System Drained Subsequent to Engine Installation)

NOTE: Refer to 5, when filling oil system at time of initial engine installation.

A. Check Drain Plugs and Oil Filter

(1) Check drain plugs (105, figure 301 and 5, figure 302) for proper installation.

(2) Verify oil filter replacement and check for proper installation.

6. B. Fill Oil Tank

CAUTION: USE ONLY APPROVED OIL (TABLE 301).

NOTE: Total amount of oil required to fill a completely drained engine is approximately 12 quarts.

(1) Remove filler plug (125 or 130, figure 301).

(2) Fill tank with oil until liquid level gage or gage (170 or 175) indicates full.

(3) Reinstall filler plug (125 or 130).

C. Run Engine

WARNING: AREAS IN PROXIMITY OF ENGINE INLET AND EXHAUST ARE EXTREMELY HAZARDOUS TO PERSONNEL WHEN ENGINES ARE OPERATING. PERSONNEL SHALL CLEAR THESE AREAS DURING ENGINE START AND OPERATION TO AVOID INJURY.

CAUTION: SHUT DOWN ENGINE IMMEDIATELY IF OIL PRESSURE IS NOT INDICATED WITHIN TEN SECONDS.

(1) Perform normal engine start and accelerate to idle speed in accordance with Aircraft Flight Manual.

(2) Run engine for at least five minutes, then perform normal engine shutdown.

D. Recheck Oil Level

(1) Recheck oil level in tank.

(2) If required, add oil in accordance with B.

7. Fuel Filter Requirements

A. Clean or replace fuel filter element after initial 25 hours of engine operation.

(1) Refer to 11, Inspection/Check for fuel filter element removal and installation procedures.

(2) Refer to 3, Cleaning/Painting for fuel filter element cleaning procedures.

8. Accessory Drive Gearbox Assembly Spline Lubrication

A. Requirements

Lubricate accessory drive gearbox assembly splines prior to installing airframe-furnished accessories.

B. Lubricate Splines

Pack spline cavity of each drive spline on forward face of accessory drive gearbox with one of the following lubricants.

Grease (Aeroshell 17 (MIL-G-21164))

Grease (Aeroshell 22 (MIL-G-81322))

Grease (Mobil Grease No. 28 (MIL-G-81322))

Grease (Mobil Grease No. 29 (Molybdenum-disulphide)) (MIL-G-81827)

Grease (MIL-G-21164)

CHAPTER 72 - GENERAL - REMOVAL/INSTALLATION

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GENERAL - REMOVAL/INSTALLATION

1. General

Removal/Installation procedures resulting from unscheduled inspections or malfunctioning components are not provided in this publication. Refer to Maintenance Manual, Report No. 72-02-02.

CHAPTER 72 - ADJUSTMENT/TEST

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GENERAL - ADJUSTMENT/TEST

1. General

Instructions contained in this section are provided for use when maintenance actions are performed on the engine. Instructions are restricted to those that can be performed without special tools or test equipment. Complete and detailed tests and adjustments of the engine and engine components are outlined in Light Maintenance Manual, Report No. 72-02-02, or may be provided by approved service centers where specialized test and calibration equipment is available.

Table 501 provides operating limits and lists corrective actions required when engine operating limits are exceeded.

NOTE: In order to satisfy high quality operational standards, as well as ensuring the accuracy of readings obtained during the test and calibration of the equipment, it is recommended that all instrumentation and gages to be used be checked on a periodic basis against instrumentation and gages of known accuracy.

Table 501. Operating Limits

Condition	Operating Limits	Action if Exceeded
NOTE: The following operating limits are included for reference purposes with respect to the corrective maintenance action required if the limits are exceeded. Refer to Aircraft Flight Manual for specific details regarding engine operation.		
ENGINE START TIMES:		
(1) From 10 percent N2 speed to light-off	10 seconds (maximum)	Abort start. Determine cause and correct before further start attempt.
(2) From light-off to idle	50 seconds (maximum)	Abort start. Determine cause and correct before further start attempt.
(3) Air starts	25 seconds (maximum) from initial fuel flow to 60 percent N2	Abort start. Determine cause of failure to start and correct before further attempt.
ENGINE OIL PRESSURE: (At Normal Operating Temperature)		
(1) Takeoff, climb, and cruise	38 to 46 psig	Shut down engine as soon as possible. Determine cause and correct.
(2) Idle	25 to 46 psig	Shut down engine as soon as possible. Determine cause and correct.
(3) Maximum transient	55 psig (3 minutes maximum) (See note preceeding oil temperature operating limits.	Shut down engine as soon as possible. Determine cause and correct.

Table 50 Operating Limits (Cont)

Condition	Operating Limits	Action if Exceeded
OIL TEMPERATURE:		
NOTE: Starting the engine at temperatures as low as -54C (-65F) is permitted provided that adequate cranking torque is available and that the fuel viscosity is at or above the pour point. If the engine is exposed to extremely cold temperatures (below -40C (-40F)) for extended periods, the engine should be heated prior to attempting a start. During cold oil temperature starts, higher than normal oil pressure can be expected which may exceed the maximum allowable transients observed during normal temperature starts. Exceeding idle power with oil temperature below 30C (86F) is not recommended in the interest of optimum engine and lubrication performance. In addition, exceeding idle power with oil temperature below 30C (86F) is not recommended due to reduced fuel icing protection from the fuel heater. However, if ambient temperature prevents attainment of 30C (86F) oil temperature, idle power may be exceeded as required.		
	Starting, minimum: (See Note) Continuous operation minimum: 30C (86F)	Heat engine prior to start.
	Maximum: 127C (261F) up to 30,000 ft, 140C (284F) above 30,000 ft.	Determine cause and correct.
	Transient: 149C (300F) (two minutes at any operational altitude)	Determine cause and correct.

Table 501. Operating Limits (Cont)

Condition	Operating Limits	Action if Exceeded
PERMISSIBLE OPERATING RANGES:		
(1) Air starts	Refer to Aircraft Flight Manual.	Determine cause and correct.
(2) Altitude	Refer to Aircraft Flight Manual.	Determine cause and correct.
INTERSTAGE TURBINE TEMPERATURE (ITT) (Tt5):		
(1) Starting (Ground/Air)	860C (1580F)	Abort start. Attempt to determine cause and correct before attempting restart.
	860C (1580F) to 880C (1616F) for less than 10 seconds	Abort start. Enter max temperature and duration in excess of limit in engine log. Determine cause and correct.
	860C (1580F) to 880C (1616F) for more than 10 seconds, or over 880C (1616F) for less than 5 seconds	Enter max temperature and duration in excess of limit in engine log. Determine cause and correct. Perform static takeoff power check in accordance with Aircraft Flight Manual.
	Over 880C (1616F) for more than 5 seconds	Conduct hot section inspection in accordance with Light Maintenance Manual, Chapter/Section/Subject 72-00-00 before further engine operation.

Table 501. Operating Limits (Cont)

Condition	Operating Limits	Action if Exceeded
INTERSTAGE TURBINE TEMPERATURE (ITT) (Tt5): (Cont)		
(1) Starting (Ground/Air) (Cont)	Any time 930C (1706F) is attained or exceeded	Conduct overtemperature hot section inspection in accordance with Light Maintenance Manual, Chapter/Section/Subject 72-00-00 before further engine operation.
(2) Takeoff	860C (1580F) for 5 minutes maximum	Reduce power setting to bring ITT within limits. Enter max temperature and duration in excess of limit in engine log.
		If 880C (1616F) is attained or exceeded, conduct hot section inspection in accordance with Light Maintenance Manual, Chapter/Section/Subject 72-00-00 before further engine operation.

Table 501. Operating Limits (Cont.)

Condition	Operating Limits	Action if Exceeded
INTERSTAGE TURBINE TEMPERATURE (ITT) (Tt5): (Cont)		
(3) Takeoff transient	870C (1598F) for 10 seconds maximum	Reduce power setting to bring ITT within limits. Make electronic computer N1 adjustment prior to next flight. Observe takeoff ITT limit.
	870C (1598F) for more than 10 seconds or 880C (1616F) attained	Conduct hot section inspection in accordance with Light Maintenance Manual, Chapter/Section/ Subject 72-00-00 before further engine operation.
	930C (1706F) attained or exceeded	Conduct overtemperature hot section inspection in accordance with Light Maintenance Manual, Chapter/Section/ Subject 72-00-00 before further engine operation.

Table 501. Operating Limits (Cont)

Condition	Operating Limits	Action if Exceeded
INTERSTAGE TURBINE TEMPERATURE (ITT) (Tt5): (Cont)		
(4) Maximum climb	796C (1465F) to 832C (1530F) (30 minute limit)	Reduce power setting to bring ITT within limits. Repeated application of time limit is not authorized during one takeoff or landing cycle. After completion of climb segment and acceleration to cruise mach number, or after 30 minutes in ITT climb range, max cruise limitations become applicable.
(5) Maximum continuous	832C (1530F)	Reduce power setting to bring ITT within limits. Maximum continuous rating without time limitation is authorized only for use in aircraft certification or in emergency conditions.
(6) Maximum cruise	795C (1463F)	Reduce power setting to bring ITT within limits.

Table 501. Operating Limits (Cont)

Condition	Operating Limits	Action if Exceeded
ROTOR SPEEDS:		
NOTE: N1 refers to low-pressure-rotor speed: 100 percent = 20,688 rpm N2 refers to high-pressure-rotor speed: 100 percent = 29,692 rpm		
(1) Takeoff and maximum continuous/climb	Refer to Aircraft Flight Manual.	Reduce power setting to bring N1/N2 within limits. Make necessary electronic computer adjustment prior to next operation. Observe transient limits.
(2) Transient	N1 - 100 to 103 percent (1 min) N2 - 100 to 103 percent (1 min) N1 - 103 to 105 percent (5 sec) N2 - 103 to 105 percent (5 sec)	Reduce power setting to bring N1/N2 within limits. Make necessary electronic computer adjustment prior to next operation. Observe speed limit.
(3) Overspeed	N1 - 105 percent N2 - 105 percent	Reduce power setting to bring N1/N2 within limits. Perform overspeed inspection in accordance with Light Maintenance Manual, Chapter/Section/Subject 72-00-00, GENERAL - INSPECTION/CHECK any time 105 percent N1 or N2 is exceeded before further engine operation.

Table 501. Operating Limits (Cont)

Condition	Operating Limits	Action if Exceeded
SUDDEN STOPPAGE OR EXTERNALLY INOUCED ENGINE DECELERATION:	Any deceleration of engine due to impact with any object.	Shut down engine. Determine cause and correct.
SHUTDOWN:	Operate for at least 2 min at 38 percent N1 or below prior to shutdown.	Check for possible seizure or rub of the rotors.
Roll down	From point of fuel cutoff, N1 roll down time shall be 50 seconds or more and N2 roll down time shall be 30 seconds or more. N2 shall roll down at least 15 seconds prior to roll down of N1.	Check for possible seizure or rub of the rotors. Refer to GENERAL - TROUBLE SHOOTING.
OIL USAGE RATE:	0.05 gallon per hour when measured over a 15-hour period.	Inspect engine for external oil leaks. Determine cause and correct.
FUEL INLET PRESSURE:	5 psi above true vapor pressure but not to exceed 50 psig.	Determine cause and correct. If limit is exceeded for 10 or more hours of engine operation, return fuel pump to a Garrett approved repair center for inspection.
IGNITION SYSTEM OPERATION:	*As required.	Check for satisfactory operation during next ground start.

*NOTE: Use of continuous ignition except as required will necessitate premature replacement of igniter plugs.

2. Engine Pre-Start Procedure

WARNING: AREAS IN PROXIMITY OF ENGINE INLET AND EXHAUST ARE EXTREMELY HAZARDOUS TO PERSONNEL WHEN ENGINE IS OPERATING. PERSONNEL SHALL CLEAR THESE AREAS DURING ENGINE START AND OPERATION TO AVOID INJURY.

CAUTION: DO NOT RUN ENGINE WITHOUT PROPER AIRCRAFT PRIMARY (CORE) EXHAUST NOZZLE AND AIRCRAFT INLET DUCT INSTALLED. DO NOT RUN ENGINE ABOVE GROUND IDLE SPEED WITHOUT PROPER AIRCRAFT FAN BYPASS DUCT INSTALLED. ENGINE DAMAGE WILL RESULT IF DUCTS ARE NOT USED AS SPECIFIED. REFER TO AIRCRAFT MAINTENANCE MANUAL FOR INSTALLATION OF DUCTS.

A. Pre-Start Procedures

NOTE: Operation of switches and controls as described with reference to function performed to the engine does not reflect a specific installation. Aircraft installation may combine switches with each other and with other controls. Refer to Aircraft Flight Manual for cockpit control arrangement and operation.

(1) Perform preflight inspections outlined in the Aircraft Flight Manual.

(2) Check run-up area for any loose objects in the vicinity of the engine air inlet and rear of the engine. Remove those objects that could interfere with the air intake.

(3) Check all engine controls for freedom of movement.

NOTE: If an external power source is used, check to ensure proper connection and 1000 amp minimum capacity.

(4) If available, use an external power source for starting engine.

3. Engine Start Procedure

NOTE: All engine starts made in accordance with procedures of this manual shall be made in the normal mode (engine electronic computer turned on and operating), as specified in the Aircraft Flight Manual. Except where specifically noted in the following procedures, the electronic computer shall remain operating when running the engine.

3. A. Start Procedures

(1) Ensure aircraft covers for engine intake and exhaust are removed.

NOTE: If required to clear engine of fuel, as when attempting a start following a false start, either allow three minutes for fuel to drain from engine or motor engine for 15 seconds with power lever at fuel cutoff position.

(2) Start engine in accordance with Aircraft Flight Manual.

4. Engine Fire On Ground During Start Procedure

A. Fire on Ground Procedures

(1) If fire is burning within tailpipe area, shut off fuel to engine, then motor engine to blow out fire.

(2) If fire is in engine compartment or nacelle, move power lever to fuel cutoff position to manually close fuel shutoff valve, then activate fire extinguisher switch.

5. Engine Ground Idling Information

A normal characteristic of the engine which may be observed at idle speed (28.5 percent N1) is a cyclic increase and decrease of N1. The cycling is characterized by a sequence as follows: fuel flow increases with no increase in N1; N1 then increases; fuel flow decreases with no decrease in N1; N1 then decreases; cycle repeats. This characteristic is due to normal fuel pressure changes within the fuel manifold caused by low flow rates which do not maintain constant flows from all secondary nozzles of the fuel manifold. This characteristic may be confirmed as the cause of cycling by increasing the power lever position to provide 250 to 300 pounds per hour fuel flow, which stops cycling. The cycling characteristic is normal at low flow rates and has no effect on operation or flight safety.

6. Engine Shutdown Procedure

A. Observe Shutdown Procedures

(1) Shut down engine in accordance with Aircraft Flight Manual.

(2) Allow engine cool-down period of at least 15 minutes before installing aircraft covers for engine intake and exhaust.

7. Electronic Computer Adjustment Procedure

NOTE: Graphs required for computer adjustment give barometric pressures in inches of mercury or use pressure altitude in feet. If desired, convert either parameter using graph of Figure 501.

The following adjustments are required when engine operation indicates N1 (with power lever angle at maximum, aircraft stationary) differs from N1 specified by applicable Aircraft Flight Manual curve, when a new or replacement electronic computer is installed, or when a new or replacement engine is installed.

A. Fuel Type Adjustment Procedure

(1) Recommended setting of fuel adjustment for various fuels is listed in Table 502. Clockwise movement of fuel adjustment knob will decrease (shorten) engine acceleration time. Counterclockwise movement of fuel adjustment knob will increase (lengthen) engine acceleration time. Excessive clockwise adjustment is undesirable since it may result in engine compressor instability (surge) during rapid power lever advance. Excessive adjustment in the counterclockwise direction is also undesirable in that it may reduce engine acceleration capability to an undesirable extent and may result in lean blowout.

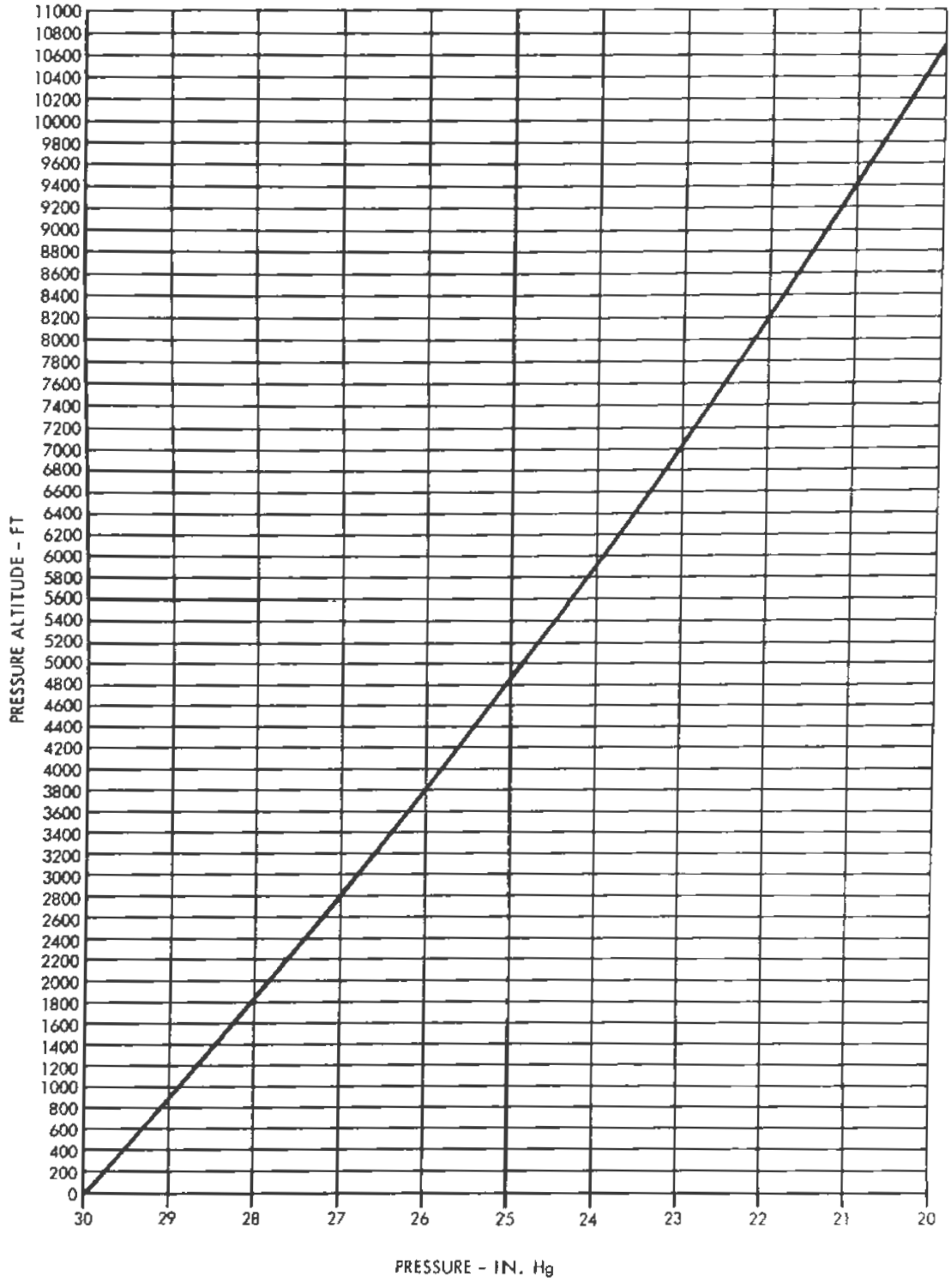
(2) A fuel adjustment setting of up to one click (or position number) in either direction from the recommended fuel adjustment (table 502) is allowable to compensate for individual engine characteristics or installation effects.

Table 502. Recommended Fuel Adjustment

Fuel Used	Fuel Adjustment Setting (See figure 502 or 503)
Jet A/A1/JP5	Position 5
Jet B/JP4	Position 6
Aviation Gasoline (80/87, 100/130, or 115/145 octane)*	Position 7
50% or more Jet A/A1/JP5	Position 5
50% or more Jet B/JP4	Position 6
50% or more Aviation Gasoline*	Position 7

*NOTE: Use of aviation gasoline is limited to not more than 500 gallons per 100 hours of operation other than during emergency operation.

NOTE: AN AIRCRAFT ALTIMETER MAY BE USED TO DETERMINE AMBIENT PRESSURE BY ADJUSTING THE ALTIMETER TO 29.92 IN. Hg AND READING PRESSURE ALTITUDE DIRECTLY. CORRESPONDING AMBIENT PRESSURE IS SHOWN ON THIS CURVE.



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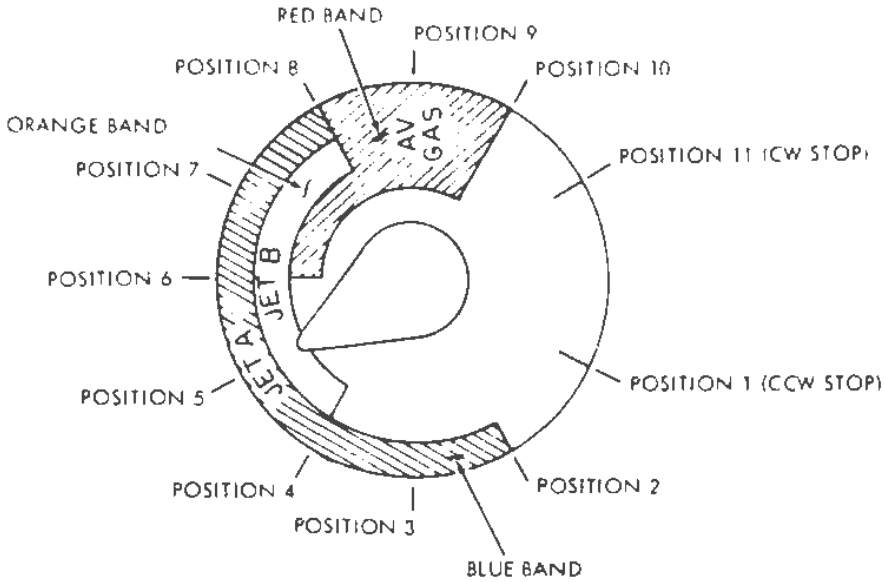
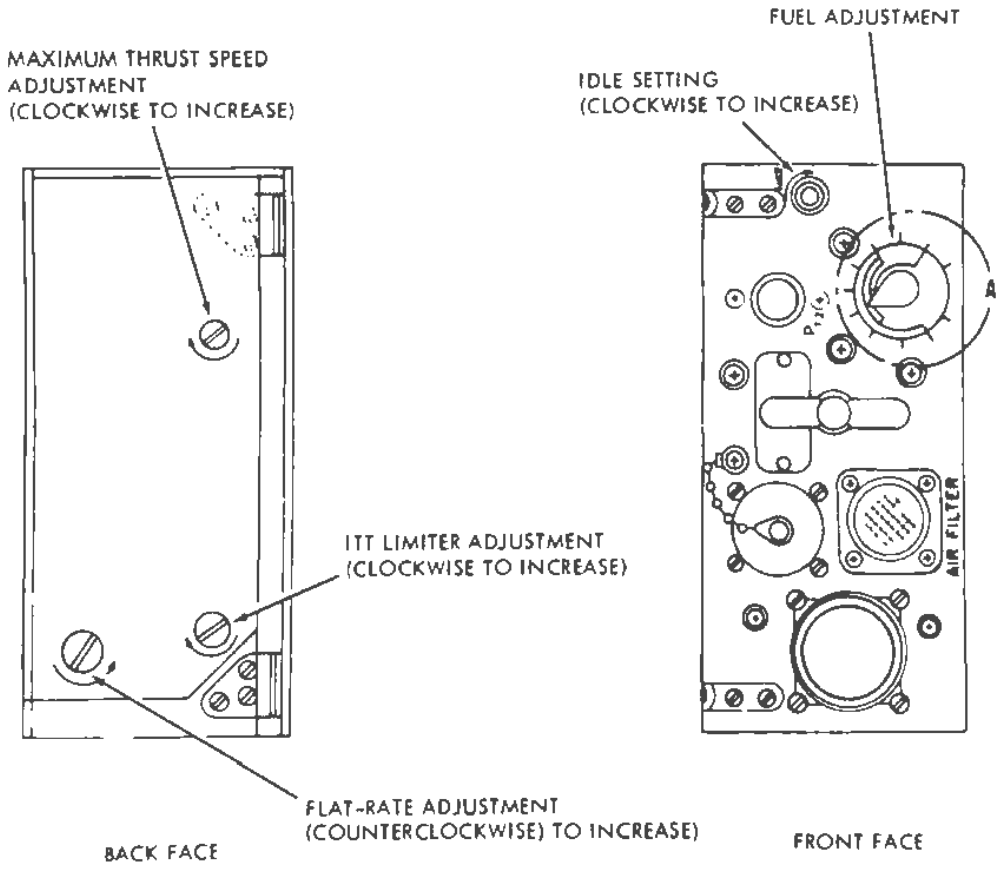
Ambient Pressure Conversion
Figure 501

NOTE:
POSITION NUMBERS SHOWN FOR FUEL ADJUSTMENT ARE ESTABLISHED BY COUNTING DETENT POSITIONS FROM THE CCW STOP ON THE CONTROL. POSITION NUMBERS DO NOT APPEAR ON THE CONTROL.



DETAIL A



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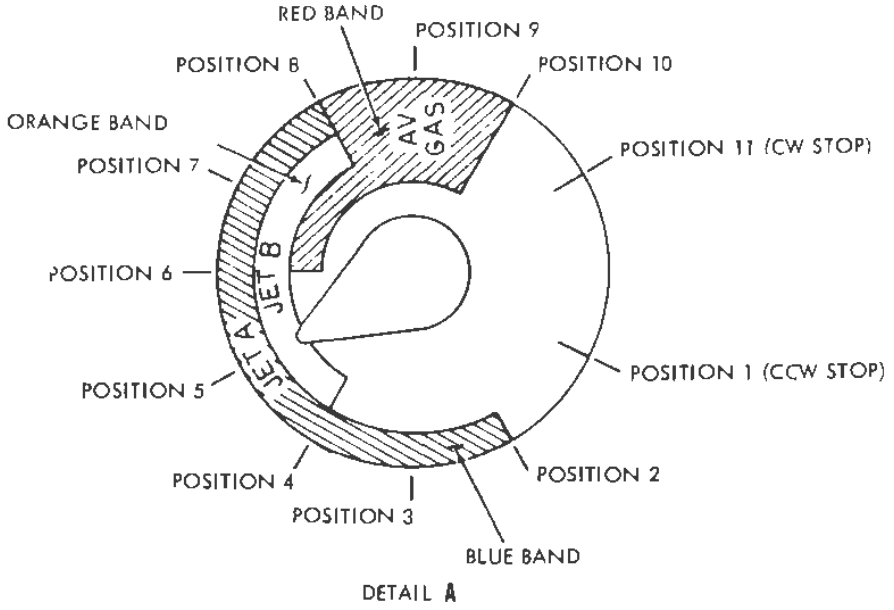
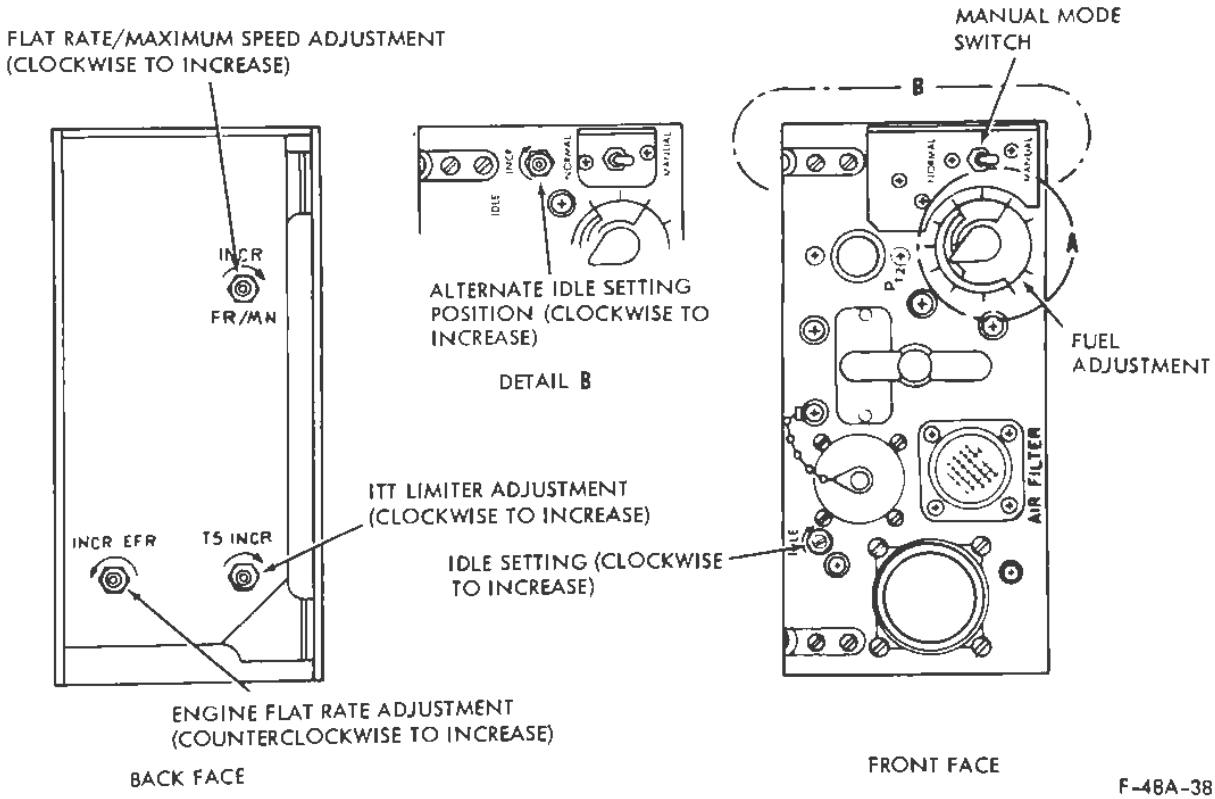
(Pre SB 76-3007) Electronic Computer
Adjustment Points
Figure 502

NOTE:
POSITION NUMBERS SHOWN FOR FUEL ADJUSTMENT ARE ESTABLISHED BY COUNTING DETENT POSITIONS FROM THE CCW STOP ON THE CONTROL. POSITION NUMBERS DO NOT APPEAR ON THE CONTROL.



DETAIL A



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(Post SB 76-3007) Electronic Computer
Adjustment Points
Figure 503

7. B. (Pre SB 76-3007) Maximum Low Pressure Rotor Speed (N1) Adjustment Procedures

NOTE: The following adjustments are required when engine operation indicates N1 (with power lever angle at maximum, aircraft stationary) differs from N1 specified by applicable Aircraft Flight Manual curve, when a new or replacement electronic computer is installed or when a new or replacement engine is installed.

(1) Determine hot or cold day condition as follows.

(a) Note outside air temperature (free air static temperature obtained from ground meteorological sources) and indicated pressure altitude.

(b) Enter Figure 504 with conditions noted in step (a).

1 If outside air temperature and barometric pressure lines intersect in area of graph identified as hot day (above curve), perform hot day adjustment procedure outlined in step (2).

2 If outside air temperature and barometric pressure lines intersect in an area of graph identified as cold day (below curve), perform cold day adjustment procedure outlined in step (3).

(2) Perform hot day flat-rate (FR) ground check and adjustment procedure as follows.

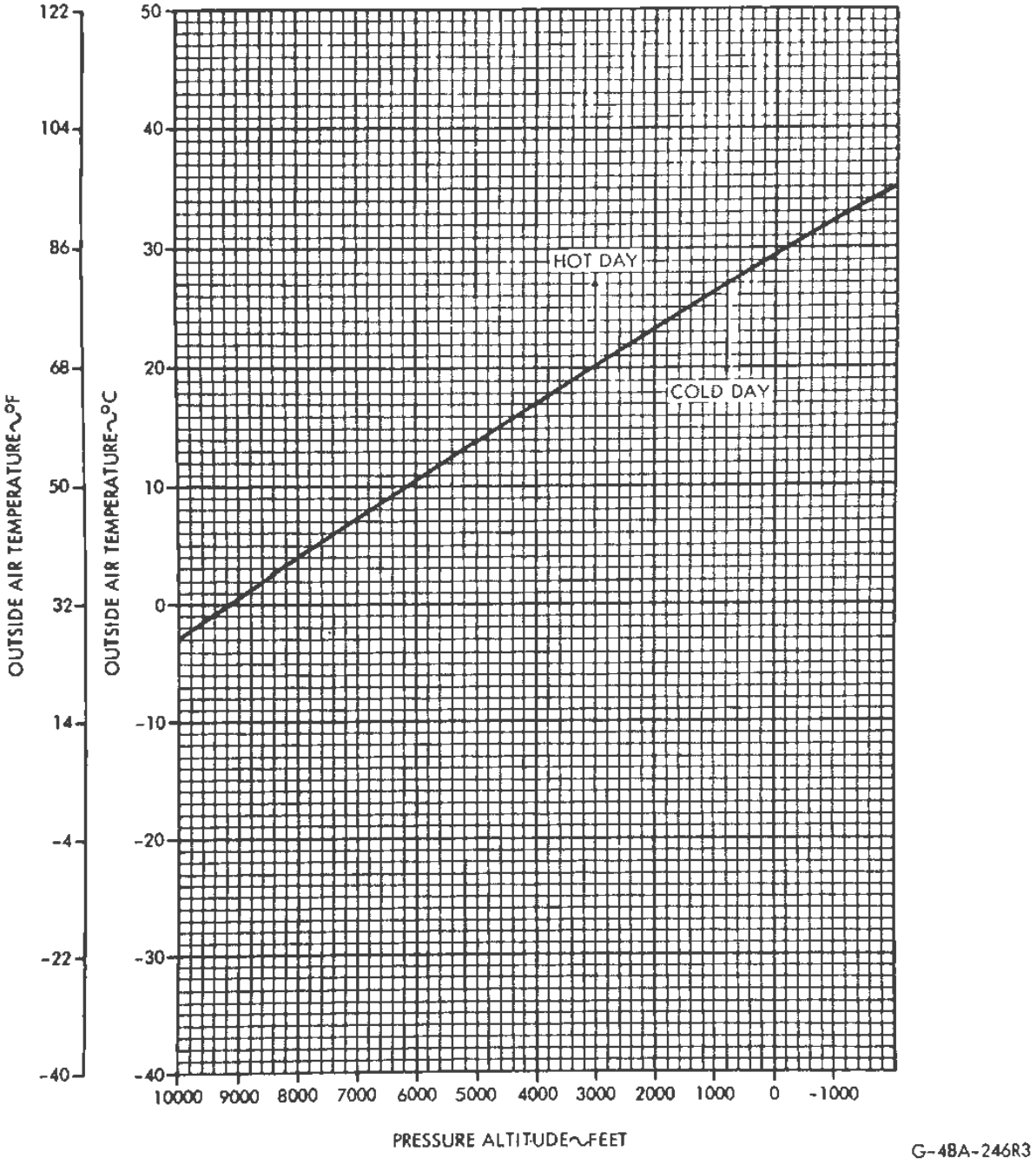
(a) Determine maximum low pressure rotor speed (N1) in accordance with Aircraft Flight Manual, using outside air temperature (free air static temperature obtained from ground meteorological sources) and indicated pressure altitude.

(b) Determine number of turns for indirect setting of flat-rate (FR) adjustment on electronic computer as follows.

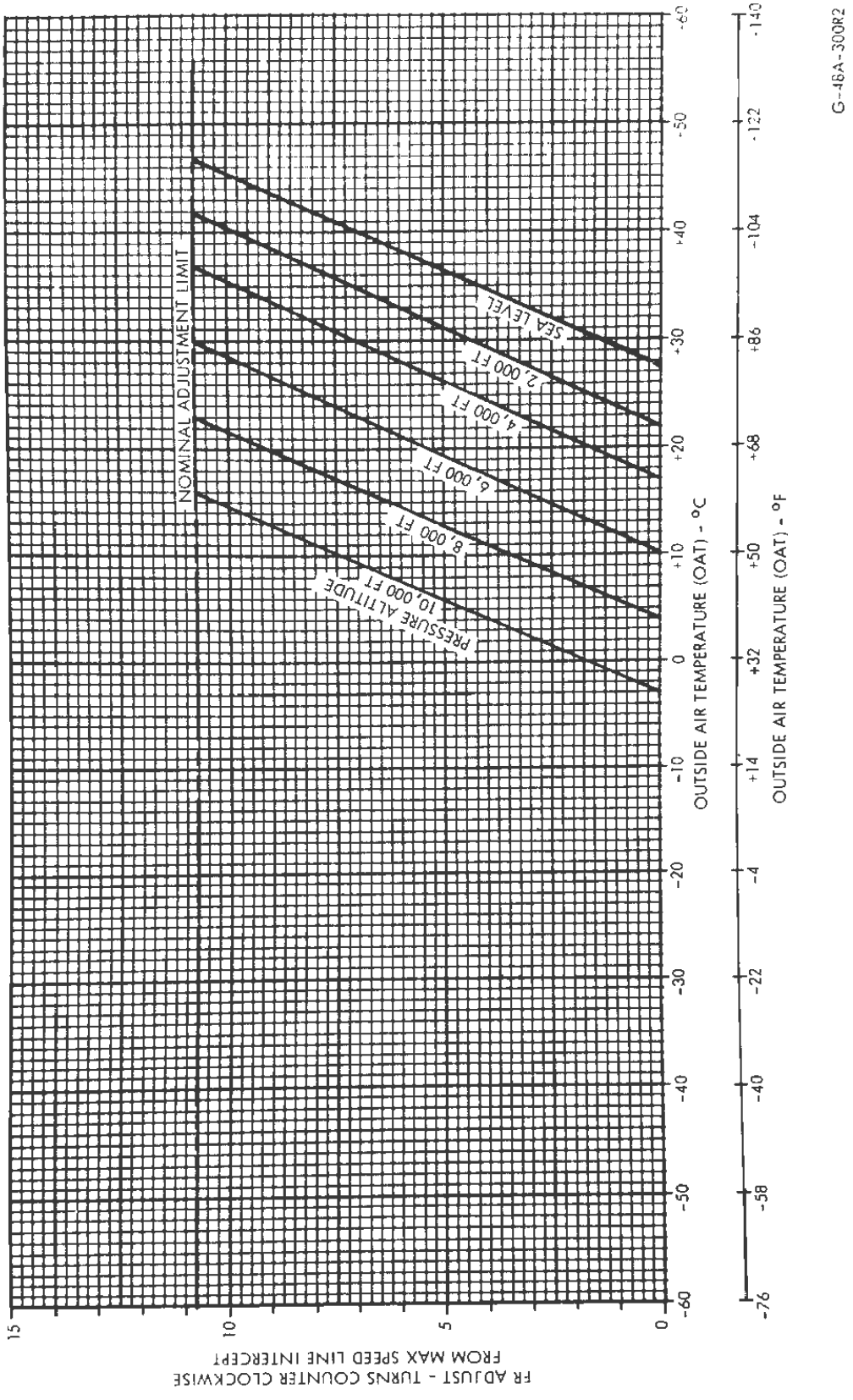
NOTE: If intersection of outside air temperature and indicated pressure altitude lines is beyond indicated nominal adjustment limit in the following step, postpone indirect setting of flat-rate (FR) adjustment until cooler temperature prevails.

1 Enter Figure 505 with outside air temperature and locate intersection of outside air temperature and indicated pressure altitude lines.

2 Note corresponding number of turns required.



Hot, Cold Day Definition
Figure 504



(Pre SB 76-3007) Hot Day: Computer Adjustment for Flat-Rate (FR)
Figure 505

7. B. (2) (c) Remove cover on rear face of electronic computer. Adjust flat-rate (FR) adjustment (figure 502) 22 turns counterclockwise.

(d) Adjust maximum speed (MN) adjustment (figure 502) 22 turns counterclockwise.

CAUTION: DO NOT EXCEED ENGINE OPERATING LIMITS WHEN PERFORMING THE FOLLOWING STEP.

(e) Perform normal engine start and accelerate to idle speed in accordance with Aircraft Flight Manual. Slowly advance power lever to maximum position (117 to 122 degrees power lever angle). Operate engine for two minute minimum at specified power lever angle to stabilize conditions.

CAUTION: WHEN PERFORMING THE FOLLOWING STEP, DO NOT EXCEED ITT LIMIT OF 860C (1580F). IF REQUIRED N1 CANNOT BE SET WITHIN ITT LIMIT, CONTACT GARRETT FIELD SERVICE.

ENSURE MN ADJUSTMENT DOES NOT INCREASE MN SCHEDULE ABOVE SETTING OF ITT LIMITER IN ELECTRONIC COMPUTER (ITT LIMITER IMPROPERLY SET BELOW 860C). INDICATED ITT SHOULD GRADUALLY INCREASE WITH GRADUAL INCREASE (CLOCKWISE ROTATION) OF MN ADJUSTMENT. IF THIS IS NOT OBSERVED, ITT LIMITER MAY BE OVERRIDING MN SCHEDULE, PREVENTING PROPER SETTING OF MN ADJUSTMENT. FOR THIS CONDITION, ADJUST MN ADJUSTMENT COUNTERCLOCKWISE UNTIL INDICATED ITT DECREASES WITH DECREASE (COUNTERCLOCKWISE RDTATION) OF MN ADJUSTMENT AND TROUBLE SHOOT ELECTRONIC COMPUTER FOR LOW ITT LIMITER SETTING PRIOR TO COMPLETING SETTING OF MN SCHEDULE. REFER TO LIGHT MAINTENANCE MANUAL, CHAPTER/SECTION/SUBJECT 72-00-00, ADJUSTMENT/TEST.

(f) Gradually adjust maximum speed (MN) adjustment clockwise to obtain required N1 determined in step (a).

(g) Adjust flat rating schedule by gradually turning flat-rate (FR) adjustment clockwise until either indicated N1 or ITT (select most sensitive indication for engine installation) just starts to decrease, then turn FR adjustment counterclockwise the number of turns determined in step (b).

7. B. (2) (h) Reduce power lever position to idle and perform normal engine shutdown. Install cover on rear face of electronic computer.

(i) This completes hot day adjustment procedure.

(3) Perform cold day maximum speed (MN) ground check and adjustment procedure as follows.

(a) Determine maximum low pressure rotor speed (N1) in accordance with Aircraft Flight Manual, using outside air temperature (free air static temperature obtained from ground meteorological sources) and indicated pressure altitude.

(b) Determine number of turns for indirect setting of maximum speed (MN) adjustment on electronic computer as follows.

NOTE: If intersection of outside air temperature and indicated pressure altitude line is beyond indicated nominal adjustment limit in the following step, postpone indirect setting of maximum speed (MN) adjustment until warmer temperature prevails.

1 Enter Figure 506 with outside air temperature and locate intersection of outside air temperature and indicated pressure altitude lines.

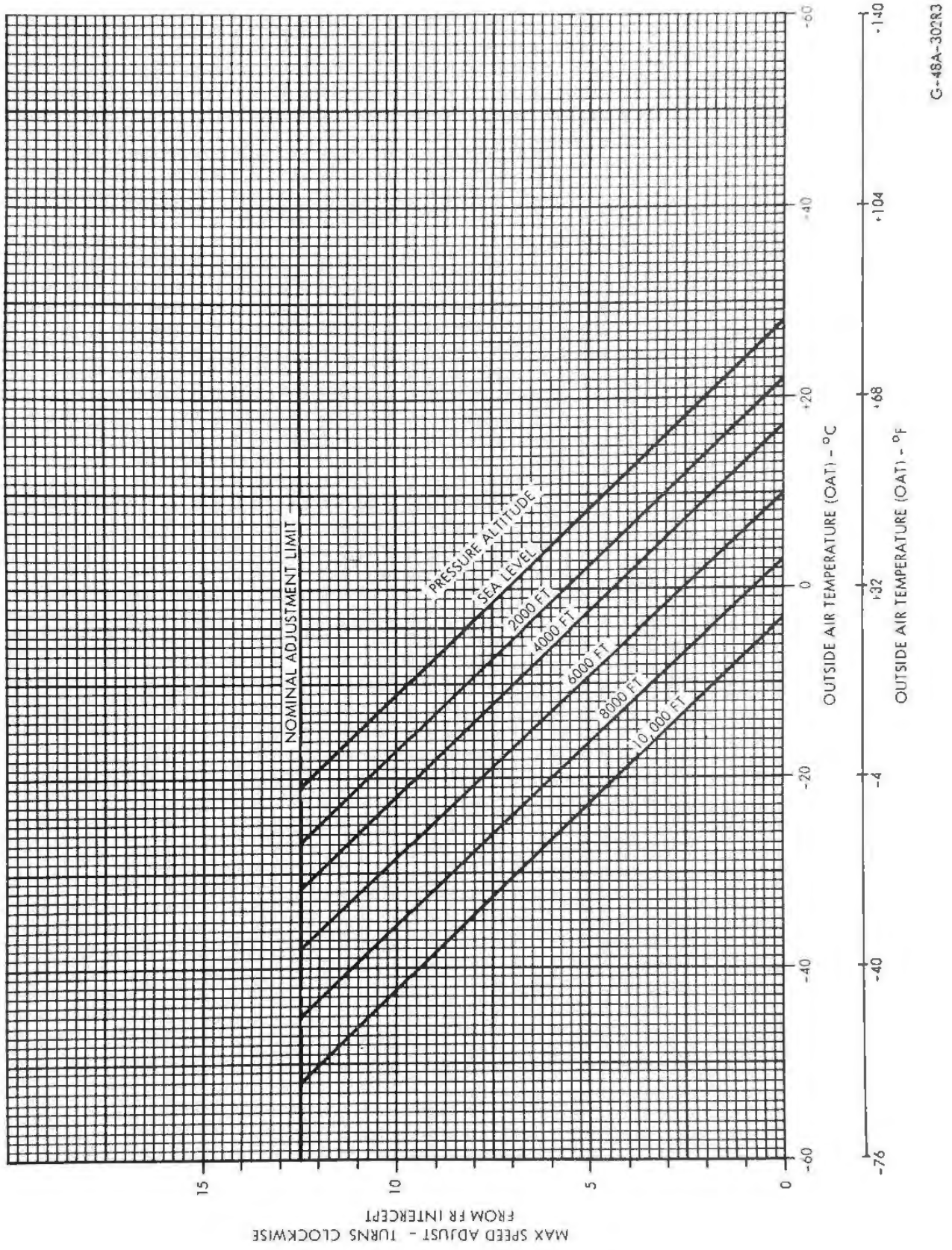
2 Note corresponding number of turns required.

(c) Remove cover on rear face of electronic computer. Adjust flat-rate (FR) adjustment (figure 502) 22 turns clockwise.

(d) Adjust maximum speed (MN) adjustment (figure 502) 22 turns clockwise.

CAUTION: DO NOT EXCEED ENGINE OPERATING LIMITS WHEN PERFORMING THE FOLLOWING STEP.

(e) Perform normal engine start and accelerate to idle speed in accordance with Aircraft Flight Manual. Slowly advance power lever to maximum position (117 to 122 degrees power lever angle). Operate engine for two minutes minimum at specified power lever angle to stabilize conditions.



(Pre SB 76-3007) Cold Day: Computer Adjustment for Maximum Speed (MN)
Figure 506

7. B. (3) (f) Gradually adjust flat-rate (FR) adjustment counterclockwise to obtain required N1 determined in step (a).

(g) Adjust maximum speed schedule by gradually turning maximum speed (MN) adjustment counterclockwise until either indicated N1 or ITT (select most sensitive indication for engine installation) just starts to decrease, then turn MN adjustment clockwise the number of turns determined in step (b).

(h) Reduce power lever position to idle and conduct normal engine shutdown. Install cover on rear face of electronic computer.

(i) This completes cold day adjustment procedure.

C. (Post SB 76-3007) Maximum Low Pressure Rotor Speed (N1) Adjustment Procedures

NOTE: The following adjustments are required when engine operation indicates N1 (with power lever angle at maximum, aircraft stationary) differs from N1 specified by applicable Aircraft Flight Manual curve, when a new or replacement electronic computer is installed, or when a new or replacement engine is installed.

(1) Perform flat rate/maximum speed (FR/MN) ground check and adjustment procedure.

(a) Set EFR adjustment (figure 503) 22 turns counterclockwise, then clockwise for the number of turns noted on decal adjacent to EFR adjustment.

(b) Refer to Aircraft Flight Manual and determine required N1 for the prevailing outside air temperature (free air static temperature obtained from ground meteorological sources) and indicated presssure altitude conditions. Record required N1.

(c) Perform normal engine start and accelerate to idle speed in accordance with Aircraft Flight Manual.

CAUTION: DO NOT EXCEED ENGINE OPERATING LIMITS WHEN PERFORMING THE FOLLOWING STEP.

(d) Slowly advance power level to maximum position (117 to 122 degrees power lever angle). Operate engine for two minutes minimum at specified power lever angle to stabilize conditions.

(e) Adjust FR/MN adjustment on electronic computer (figure 503) to obtain required percent of N1 noted in step (b). Perform normal engine shutdown.

NOTE: Step (1) provides for correct N1 adjustment at specific ambient (hot or cold day) conditions as defined by Figure 504. When ambient conditions change from hot to cold or from cold to hot, a further trim adjustment may be required to obtain specified N1 at all ambient conditions. Perform step (2) or (3), as applicable, should an N1 error become evident at changed ambient conditions.

7. C. (2) If step (1) was performed at cold day conditions and an N1 error is evident at hot day conditions, perform the following at hot day conditions.

(a) Refer to Aircraft Flight Manual and determine required N1 for the prevailing outside air temperature (free air static temperature obtained from ground meteorological sources) and indicated pressure altitude conditions. Record required N1.

(b) Perform normal engine start and accelerate to idle speed in accordance with Aircraft Flight Manual.

CAUTION: DO NOT EXCEED ENGINE OPERATING LIMITS WHEN PERFORMING THE FOLLOWING STEP.

(c) Slowly advance power lever to maximum position (117 to 122 degrees power lever angle). Operate engine for two minutes minimum at maximum power lever angle to stabilize conditions. Record actual (cockpit indicated) N1.

(d) Determine and record amount and direction of N1 error (difference of required N1 recorded in step (a) and actual N1 recorded in step (c)).

1 If actual N1 is higher than required N1, correct error as specified in step (e).

2 If actual N1 is lower than required N1, correct error as specified in step (f).

(e) Decrease actual N1 to required N1 as follows.

1 Adjust FR/MN adjustment (figure 503) counterclockwise (decrease) to provide change in N1 determined in step (d). One turn provides a change of approximately two percent N1.

2 Perform normal engine shutdown.

3 Adjust EFR adjustment (figure 503) counterclockwise (increase) for change determined in step (d). One turn provides a change of approximately 1.2 percent N1.

7. C. (2) (f) Increase actual N1 to required N1 as follows.

1 Adjust FR/MN adjustment (figure 503) clockwise (increase) to provide change in N1 determined in step (d). One turn provides a change of approximately two percent N1.

2 Perform normal engine shutdown.

3 Adjust EFR adjustment (figure 503) clockwise (decrease) for change determined in step (d). One turn provides a change of approximately 1.2 percent N1.

(3) If step (1) was performed at hot day conditions and an N1 error is evident at cold day conditions, perform the following at cold day conditions.

(a) Refer to Aircraft Flight Manual and determine required N1 for the prevailing outside air temperature (free air static temperature obtained from ground meteorological sources) and indicated pressure altitude conditions. Record required N1.

(b) Perform normal engine start and accelerate to idle speed in accordance with Aircraft Flight Manual.

CAUTION: DO NOT EXCEED ENGINE OPERATING LIMITS WHEN PERFORMING THE FOLLOWING STEP.

(c) Slowly advance power lever to maximum position (117 to 122 degrees power lever angle). Operate engine for two minutes minimum at specified power lever angle to stabilize conditions.

(d) Adjust EFR adjustment on electronic computer (figure 503) to obtain required percent of N1 noted in step (a). One turn provides a change of approximately 1.2 percent N1. Perform normal engine shutdown.

NOTE: The adjustment procedures outlined in paragraph D, are required when engine operation indicates N1 (with power lever angle at idle position) differs from N1 specified by Figure 507, when a new or replacement electronic computer is installed, or when a new or replacement engine is installed.

When performing the adjustment procedures of paragraph D, engine bleed air demand shall be zero and engine accessory drive loading (electrical and hydraulic) shall be zero or minimum achievable.

7. D. Idle Speed (N1) Adjustment Procedure

(1) Note outside air temperature (free air static temperature obtained from ground meteorological sources) and indicated pressure altitude.

(2) Determine low pressure rotor speed (N1) required for noted conditions.

(a) Enter Figure 507 and locate intersection of outside air temperature and indicated pressure altitude lines.

(b) Note corresponding N1 percent required.

(3) Perform normal engine start and accelerate to idle speed in accordance with Aircraft Flight Manual. Set power lever to idle.

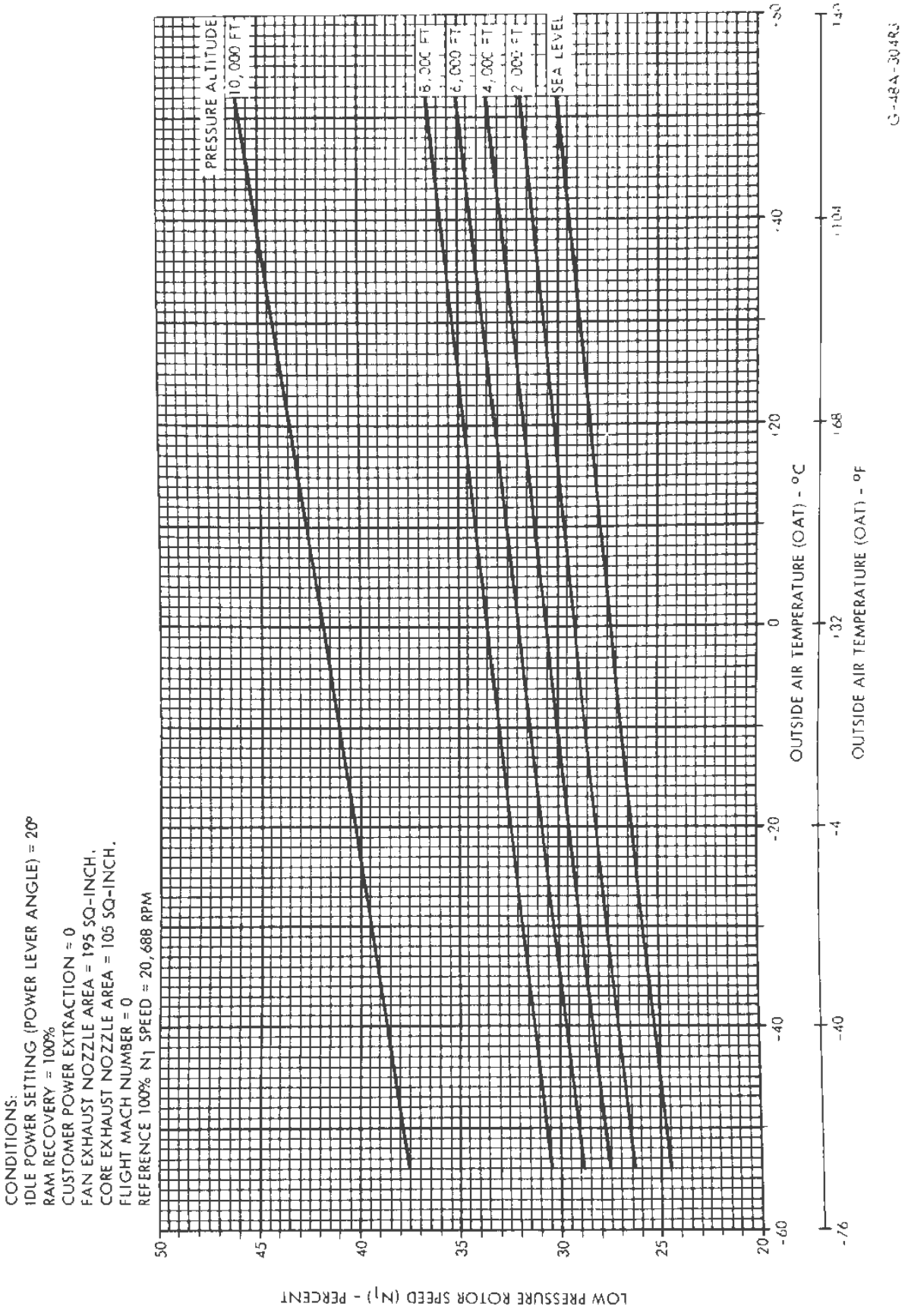
CAUTION: IF CAPPING OF SECONDARY FUEL FLOW IS NECESSARY TO SET IDLE ADJUSTMENT IN THE FOLLOWING STEP, DO NOT ADVANCE POWER LEVER BEYOND IDLE POSITION WITHOUT FLOW DIVIDER VALVE RECONNECTED FOR NORMAL OPERATION.

NOTE: If N1 cycling occurs and is of such magnitude that idle adjustment of the following step cannot be made, shut down engine and cap off secondary output port (figure 508) of flow divider valve to allow satisfactory completion of step (1) through (6). After completion of adjustment, reconnect secondary output for normal operation.

(4) Gradually adjust idle setting (figure 502 or 503) (clockwise to increase N1, counterclockwise to decrease N1) to obtain N1 determined in step (2).

(5) Perform normal engine shutdown.

(6) This completes idle adjustment procedure.



Determining Low Pressure Rotor
Idle Speed (N1) Requirements
Figure 507

8. Fuel Control Manual Mode Adjustment Procedure

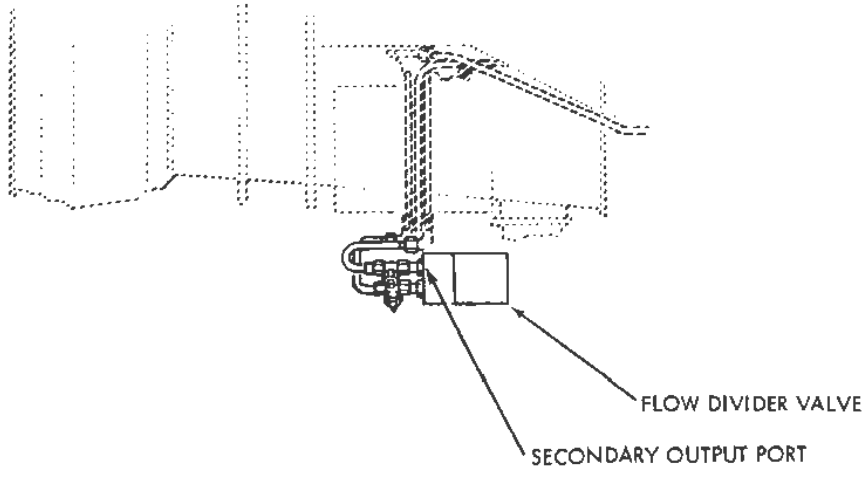
NOTE: The adjustment procedures of paragraph A shall be made when a new or replacement fuel control is installed on the engine and/or upon engine replacement. Also, upon an engine replacement, accomplish computer adjustment/test in accordance with paragraph 7.A. through 7.D. prior to accomplishing the following adjustments.

A. Fuel Control Adjustment Procedures

(1) Adjust manual governor cam adjustment (figure 509) four turns counterclockwise from the flush position then one turn clockwise.

(2) Perform normal engine start and accelerated to idle speed in accordance with Aircraft Flight Manual.

NOTE: Manual mode idle rpm (approximately 20 degrees power lever angle) is not adjustable and may be higher or lower than normal mode idle rpm; this is not cause for fuel control rejection.



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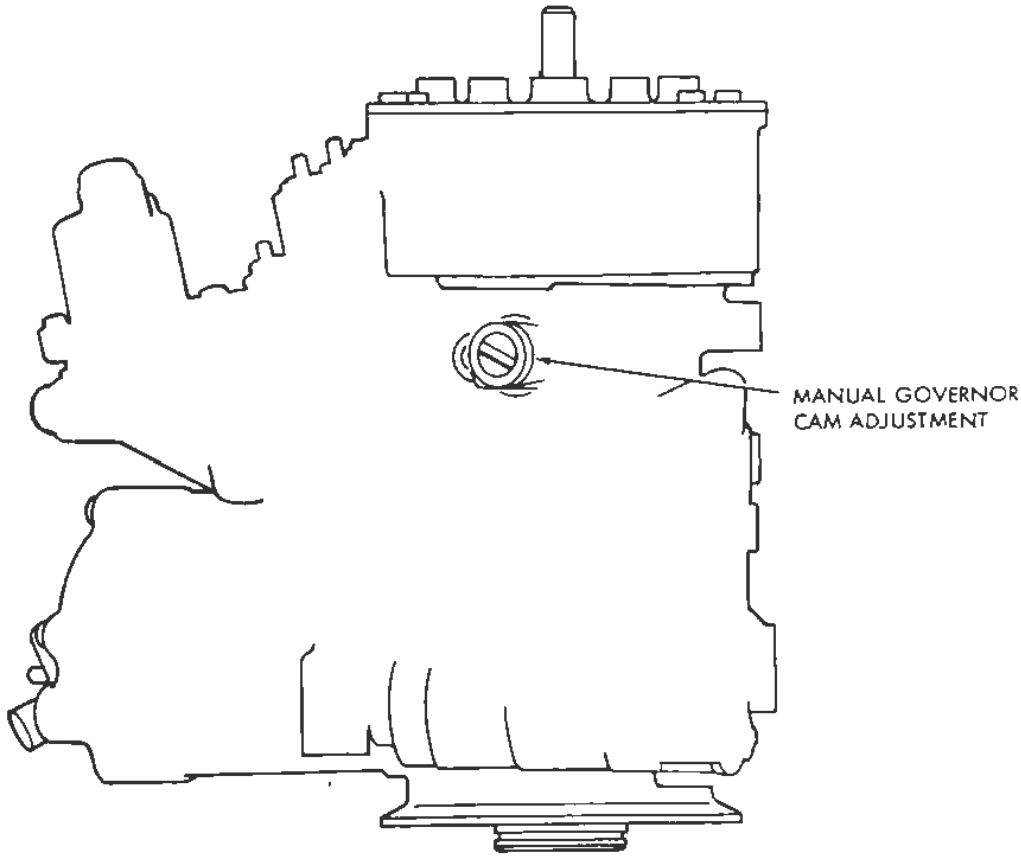
Flow Divider Valve Secondary Output Port
Figure 508



F-48A-387

Fuel Control
Figure 509

8. A. (3) De-energize electronic computer.

CAUTION: DO NOT EXCEED ENGINE OPERATING LIMITS OF N1, N2, OR ITT WHEN PERFORMING THE FOLLOWING STEP.

(4) Slowly advance power lever to maximum power lever angle (117 to 122 degrees) in accordance with Aircraft Flight Manual and operate engine for two minutes minimum to stabilize conditions, then record manual mode ITT.

(5) Return power lever to idle, energize electronic computer, and perform normal engine shutdown.

(6) Subtract manual mode ITT recorded in step (4) from target ITT of 855C (1561F). Record result as delta ITT.

(7) Determine number of turns required for manual governor cam adjustment by dividing delta ITT recorded in step (6) by 38C (68.4F). Record number of turns required.

CAUTION: ANYTIME CLOCKWISE ADJUSTMENT OF MANUAL GOVERNOR CAM ADJUSTMENT IS REQUIRED WHEN PERFORMING THE FOLLOWING STEPS (ENGINE SHUTDOWN), POSITION POWER LEVER TO MAXIMUM (117 TO 122 DEGREES) POSITION PRIOR TO MAKING ADJUSTMENT. IF ANY RESISTANCE TO CLOCKWISE ROTATION OF THE MANUAL GOVENOR CAM ADJUSTMENT IS NOTED, STOP AND INVESTIGATE FOR CAUSE. CONTINUED CLOCKWISE ROTATION OF ADJUST SCREW COULD RESULT IN FAILURE OF CAM FOLLOWER IN FUEL CONTROL.

NOTE: Clockwise rotation of manual governor cam adjustment increases manual mode ITT and counterclockwise rotation decreases manual mode ITT. One full rotation provides a change of approximately 38C (68.4F).

(8) Position power lever to maximum (engine shutdown), then turn manual governor cam adjustment (figure 509) clockwise the number of turns recorded in step (7).

(9) Return power lever to cutoff. Advance power lever (engine shutdown) to maximum stop and return to cutoff.

(10) Determine hot or cold day conditions as follows.

(a) Note outside air temperature (free air static temperature obtained from ground meteorological sources) and indicated pressure altitude.

8. A. (10) (b) Enter Figure 504 with conditions noted in step (a).

1 If outside air temperature and barometric pressure lines intersect in an area of graph identified as hot day (above curve), perform steps (11), (12) and (14).

2 If outside air temperature and barometric pressure lines intersect in an area of graph identified as cold day (below curve), perform steps (11), (12) and (13). If desired, also perform cold day optional flight check of step (15).

(11) Perform normal engine start and accelerate to idle in accordance with Aircraft Flight Manual.

NOTE: If engine does not respond to power lever movement in the following step, the fuel control manual mode cam may be damaged or broken.

(12) De-energize electronic computer and advance power lever enough to determine that engine responds to power lever movement in manual mode.

(13) (Cold day conditions only) Return power lever to idle, energize electronic computer and perform normal engine shutdown.

(14) (Hot day conditions only) Perform hot day manual mode check as follows.

CAUTION: DO NOT EXCEED ENGINE OPERATING LIMITS OF N1, N2 OR ITT WHEN PERFORMING THE FOLLOWING STEP.

(a) Slowly advance power lever to maximum power lever angle (117 to 122 degrees) in accordance with Aircraft Flight Manual and operate engine for two minutes minimum to stabilize conditions, then record manual mode ITT.

(b) Return power lever to idle, energize electronic computer and perform normal engine shutdown.

(c) Manual mode ITT recorded in step (a) shall be 848C (1558F) to 860C (1580F).

CAUTION: OBSERVE CAUTION PRECEDING STEP (8) PRIOR TO PERFORMING THE FOLLOWING STEP.

(d) If required, turn manual governor cam adjustment (figure 509) the direction and number of turns required to obtain ITT within specified limits.

8. A. (14) (e) Return power lever to cutoff. Advance power lever (engine shutdown) to maximum stop and return to cutoff, then repeat steps (11), (12) and (14).

NOTE: Flight check procedure of step (15) is not required, but is the option of the individual operator if cold day verification is desired.

(15) (Cold day conditions only) If verification of manual govenor cam adjustment is desired, perform optional flight check as follows.

CAUTION: DO NOT DEVIATE FROM STEPS (a) AND (b) OR UNWARRANTED FUEL CONTROL REJECTION DUE TO BROKEN MANUAL MODE CAM OR ENGINE OVERSPEED IN MANUAL MODE MAY RESULT.

(a) The following steps must be performed with ram air temperature (RAT) above -20C (-4F); if RAT is lower than specified, postpone flight check until RAT is above -20C (-4F).

(b) Establish indicated pressure altitude of 15,000 feet, calibrated airspeed (CAS) of 280 to 300 knots, with no engine power extraction, such as, bleed-air, electrical load, etc.

(c) Retard power lever to idle and de-energize electronic computer.

CAUTION: DO NOT EXCEED ENGINE OPERATING LIMITS OF N1, N2 OR ITT WHEN PERFORMING THE FOLLOWING STEP.

(d) With conditions established in steps (a) and (b) and power lever at maximum, operate engine for two minutes minimum to stabilize ITT indication, then record manual mode ITT indication. ITT shall be 848 to 860C (1558 to 1580F).

(e) Retard power lever to idle and energize electronic computer.

(f) If flight check manual mode ITT is not within specified limits, determine number of turns and and direction required to adjust manual governor cam adjustment to provide ITT of 84^ to 860C (1558 to 1580F). Record number of turns and direction required.

CAUTION: OBSERVE CAUTION PRECEDING STEP (8) PRIOR TO PERFORMING THE FOLLOWING STEP.

8. A. (15) (g) Turn manual governor cam adjustment (figure 509) the number of turns and in direction recorded in step (f).

(h) Return power lever to cutoff. Advance power lever (engine shutdown) to maximum stop and return to cutoff, then repeat steps (11), (12) and (13). If desired, also repeat cold day optional flight check of step (15).

9. Oil Pump Pressure Regulator Adjustment Procedure

A. Pressure Regulator Adjustment Procedure

(1) Perform engine start and accelerate to idle speed in accordance with Aircraft Flight Manual.

(2) Advance power lever and stabilize N2 speed at 88 percent rpm.

(3) Allow engine oil to reach minimum operating temperature of 60C (140F).

CAUTION: PRIOR TO ADJUSTING OIL PUMP PRESSURE REGULATOR TO CORRECT HIGH OR LOW OIL PRESSURE INDICATION, ENSURE INDICATION WAS NOT CAUSED BY INSUFFICIENT OIL OR BY FAULTY AIRCRAFT INDICATOR OR TRANSMITTER.

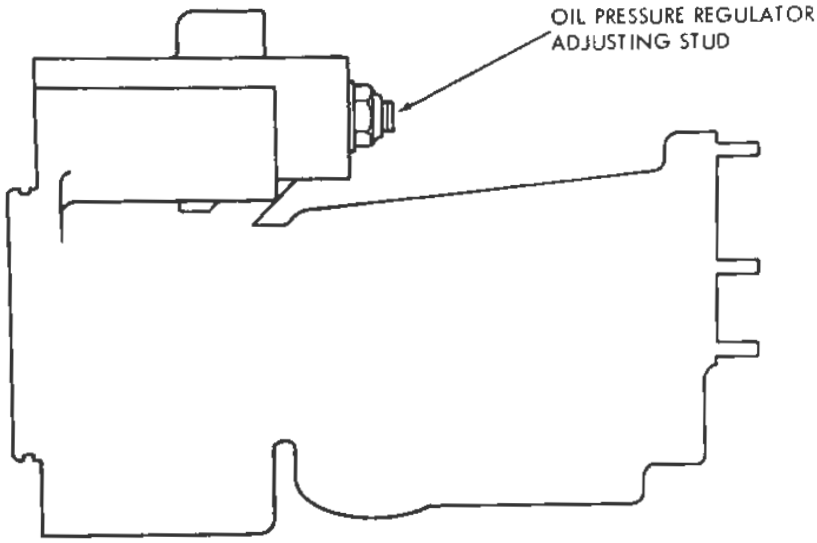
NOTE: One full turn of oil pressure regulator adjusting stud changes regulator setting approximately two psig. Rotate clockwise to increase or counterclockwise to decrease. Adjusting stud depth in oil pump body does not change when adjusted.

(4) Note oil pressure indication. If indication is not within steady-state operation limits specified in Table 501, loosen locknut and adjust oil pump pressure regulator adjusting stud (figure 510) to obtain 40 to 45 psig oil pressure indication.

NOTE: If proper adjustment cannot be obtained, pressure regulator bypass valve may be sticking. Refer to Light Maintenance Manual, Chapter/Section/Subject 79-20-03, MAINTENANCE PRACTICES for pressure regulator repair, if applicable.

Refer to STANDARD PRACTICES for general torque values. Add frictional drag (run-down) torque of selflocking devices to recommended values.

(5) Shut down engine. Tighten locknut on pressure regulator adjusting stud to torque of 30 inch-pounds without changing adjusting stud position, then install lockwire on locknut.



F-48A-154

Oil Pressure Regulator
Figure 510

10. This paragraph is not used

11. Engine Calibration Run Procedure

NOTE: Perform the following procedure as required in Light Maintenance Manual, Chapter/Section/Subject 72-00-00, and at any time degradation of engine performance is suspected. Recorded parameters of calibration run may be compared with data from earlier test runs, and with factory data by contacting Garrett Customer Service Engineering. Refer to TROUBLE SHOOTING if engine operating limits prevent performance of the following procedures.

A. Prepare Engine for Calibration Run

CAUTION: USE EXTREME CARE WHENEVER PLUG (5, FIGURE 512) IS REMOVED TO PREVENT ANY DIRT OR FOREIGN MATTER FROM ENTERING PORT. FUNCTION OF AN INTERNAL FUEL CONTROL ORIFICE WILL BE AFFECTED BY ANY CONTAMINATION ENTERING PORT.

(1) Remove plug (5, figure 512). Discard packing (10).

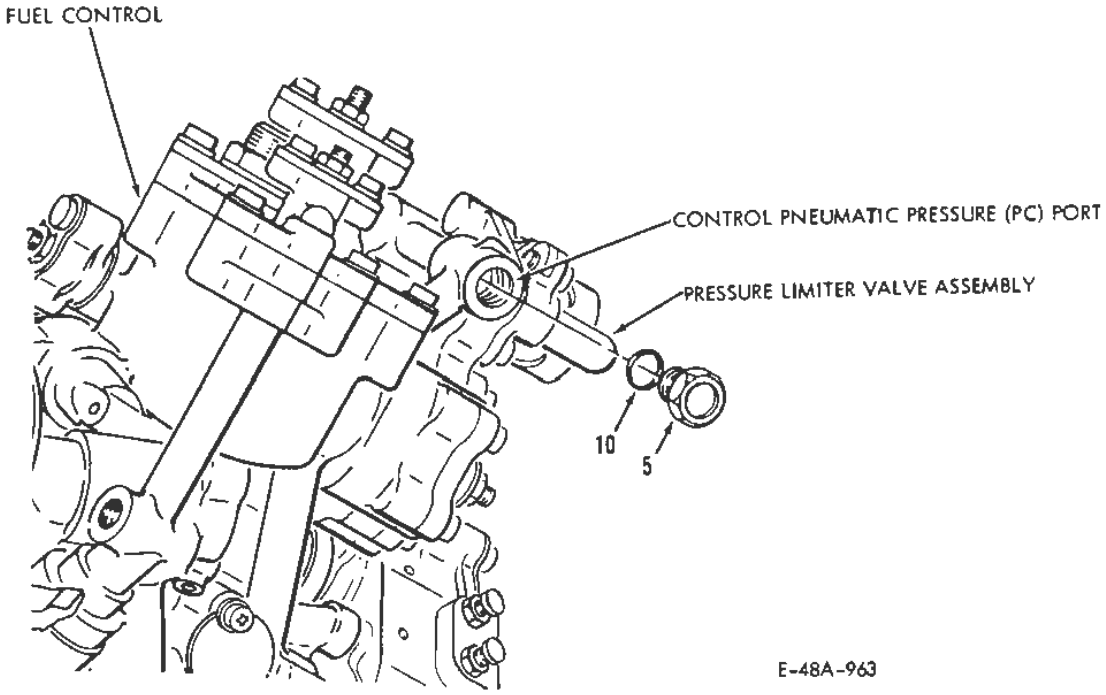
(2) Connect a 0 to 250 psig pressure gage to control pneumatic pressure port for monitoring engine P3 pressure. Connect gage in manner which will allow monitoring while engine is running.

(3) Ensure aircraft instrumentation for engine N1, N2, and ITT indications are properly calibrated and readout accuracy is as specified by Aircraft Maintenance Manual.

B. Perform Calibration Run

(1) Turn aircraft to position engine inlet into wind. Leave all systems using engine bleed air turned off throughout the following procedure.

(2) Record outside air temperature (OAT), pressure altitude, engine serial number, and aircraft serial number, (Set altimeter to 29.92 in. Hg to read pressure altitude directly.) Record normal mode maximum N1 for ambient conditions as specified in Aircraft Flight Manual. (See figure 513 for sample data recording form.)



5. PLUG (REPORT NO. 73-21-01)

10. PACKING (S9412-552)

Connecting P3 Line Pressure Gage
Figure 512

NOTE: Figure 511 is not used

TFE731 ENGINE CALIBRATION RUN DATA SHEET

DATE _____

AIRCRAFT SERIAL NO. _____

ENGINE SERIAL NO. _____

OAT _____

ENGINE TIME SINCE NEW _____

ENGINE CYCLES SINCE NEW _____

PRESSURE ALTITUDE (SET ALTIMETER TO 29.92 IN. HG.) _____

MAX N_1 FOR AMBIENT CONDITIONS _____ PER AIRCRAFT FLIGHT MANUAL

ENGINE PARAMETER	NORMAL MODE N_1 AT:					MANUAL MODE N_1 AT:
	MAXIMUM	2% BELOW MAX	4% BELOW MAX	6% BELOW MAX	IDLE	4% BELOW MAX NORMAL MODE N_1
N_1 (AIRCRAFT INDICATOR)						
N_2 (AIRCRAFT INDICATOR)						
ITT (AIRCRAFT INDICATOR)						
FUEL FLOW (AIRCRAFT INDICATOR)						
OIL PRESSURE (AIRCRAFT INDICATOR)						
OIL TEMPERATURE (AIRCRAFT INDICATOR)						
P_3 (TEST GAGE PSIG)						

ROLL DOWN TIME: N_1 _____; N_2 _____

REMARKS:

MECHANIC _____

INSPECTOR _____

G-48A-555

Engine Calibration Run Data Sheet
Figure 513

WARNING: AREAS IN PROXIMITY OF ENGINE INLET AND EXHAUST ARE EXTREMELY HAZARDOUS TO PERSONNEL WHEN ENGINES ARE OPERATING. PERSONNEL SHALL CLEAR THESE AREAS DURING ENGINE START AND OPERATION TO AVOID INJURY.

11. B. (3) Perform normal engine start and accelerate to idle speed in accordance with Aircraft Flight Manual.

CAUTION: DO NOT EXCEED ENGINE OPERATING LIMITS WHEN PERFORMING THE FOLLOWING STEPS.

(4) Advance power lever to maximum. Operate engine at maximum power lever angle for two minutes to stabilize conditions.

(5) Record the following data. (See figure 513 for sample data recording form.)

(a) N1, N2, ITT, and fuel flow from cockpit indicators.

(b) P3 pressure from gage installed in step A. (2).

(6) Retard power lever to reduce N1 two percent from maximum value recorded in step (5). Maintain N1 at this point for two minutes to stabilize conditions, then record data as specified in step (5).

(7) Retard power lever to reduce N1 four percent from maximum value recorded in step (5). Maintain N1 at this point for two minutes to stabilize conditions, then record data as specified in step (5).

(8) Retard power lever to reduce N1 six percent from maximum value recorded in step (5). Maintain N1 at this point for two minutes to stabilize conditions, then record data as specified in step (5).

(9) Retard power lever to idle position. Allow two minutes to stabilize condition, then record data as specified in step (5).

(10) De-energize electronic computer by turning cockpit on/off switch to off.

CAUTION: DO NOT EXCEED ENGINE OPERATING LIMITS WHEN PERFORMING THE FOLLOWING STEPS.

(11) Slowly advance power lever to obtain four percent less N1 than maximum N1 recorded in step (5). Ensure ITT limit is not exceeded. Allow two minutes to stabilize conditions, then record data as specified in step (5).

11. B. (12) Retard power lever to idle position. Perform normal engine shutdown in accordance with Aircraft Flight Manual. Record roll-down times for N1 and N2.

(13) Disconnect P3 gage installed at control pneumatic pressure port on fuel control.

(14) Install new packing (10, figure 512) on plug (5).

(15) Install plug (5), tighten to torque value of 30 inch-pounds, and lockwire.

(16) Maintain data recorded in the previous steps with permanent engine records. If comparison of recorded data with factory data is desired, contact Garrett Customer Service Engineering.

CHAPTER 72 GENERAL - INSPECTION/CHECK

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GENERAL - INSPECTION/CHECK

1. General

A. The inspections detailed in this section are those that can be accomplished without the aid of special tools or test equipment by an operator.

B. Inspection procedures are those which can be performed at field level. All components or parts removed from the engine shall be given a careful visual inspection for general appearance and obvious damage. A component or part which shows evidence of damage beyond field level repair capabilities shall be replaced and the damaged component or part sent to an approved service center.

2. Pre-Installation Inspection

A. Perform Pre-Installation Inspection

NOTE: Pre-installation inspections are of a general nature and are performed primarily to determine that engines received from the factory or from overhaul facility have suffered no shipping or handling damage.

(1) Check that lines are secure and free of dents.

(2) Check that all required components, instruments, and controls are included.

(3) Check for tag to determine if engine has been preserved. If engine has been preserved, proper depreservation procedures shall be performed after installation. (Refer to Light Maintenance Manual, Chapter/Section/Subject 72-00-00, GENERAL - SERVICING.)

(4) Ensure accessory drive splines of accessory drive gearbox are lubricated in accordance with 8, GENERAL - SERVICING.

3. General Inspection

A. Perform General Inspection

NOTE: The following general inspections shall be performed during any engine maintenance, as applicable, for the level of maintenance being performed.

(1) Visually inspect all accessible welded, brazed or soldered assemblies for security of joints.

3. A. (2) Visually inspect all accessible tubes for kinks, cracks, excessive wear, signs of corrosion or other damage. Inspect all fittings for broken threads, deterioration and cleanliness. Refer to Light Maintenance Manual instructions for performing a vibration check any time evidence indicates possible excessive engine vibration (cracked brackets, cracked or leaking plumbing lines, etc.).

(3) Inspect oil drained from engine. If excessive metal particles are found, perform the following inspections.

(a) Inspect magnetic plug for metal particles in accordance with 6, Chip Detector Inspection.

(b) Inspect oil filter bypass valve in accordance with 7, Oil Filter Bypass Indicator Valve Inspection.

(c) Remove, inspect, and install new oil filter in accordance with 8, Oil Filter Inspection.

(d) Forward oil sample and removed oil filter to approved SOAP laboratory in accordance with 9, Spectrographic Oil Analysis Program (SOAP) Check.

(e) Inspect interior of transfer gearbox for metal particles in accordance with 10, Transfer Gearbox Inspection.

(4) Check for fuel and oil leaks.

(5) Check drains and vents for restrictions.

(6) Check fan inlet for foreign material, obstructions, or damage.

(7) Check inlet pressure and temperature sensor for security and evidence of damage or clogging.

NOTE: If oil level has increased since last check, or if the odor of fuel is detected in the oil, test for presence of fuel in oil, in accordance with Light Maintenance Manual, Chapter/Section/Subject, 72-00-00, Inspection/Check.

(8) Check oil level.

(9) Check security of ignition wiring and connections.

(10) Check for oil seal leakage around starter-generator mount, aircraft accessory mount and fuel pump mount.

(11) Check exhaust outlet for damaged turbine blades and tailpipe for contamination or damage.

3. A. (12) Check indicator pin on fuel filter bypass indicator valve of fuel pump. If indicator pin is actuated (extended), remove and clean or replace fuel filter and clean filter cavity. Refer to 11, Fuel Filter Inspection.

(13) Check indicator pin on oil filter bypass indicator valve (figure 602) in accordance with 7.

4. Pre-Flight, Post Flight Inspections

A. Perform Pre-Flight Inspection

(1) Inspect air inlet and exhaust areas for obstruction and evidence of foreign object damage. Remove any obstructions. Refer to Light Maintenance Manual to repair or replace damaged engine components.

(2) Inspect engine air inlet and exhaust areas for evidence of oil leakage. If evidence of oil leakage is observed, determine cause and correct in accordance with Light Maintenance Manual.

B. Perform Post Flight Inspection

(1) Check level of engine lubricating oil and service if required. (Refer to GENERAL - SERVICING.)

(2) Check indicator pin on fuel filter bypass indicator valve of fuel pump. If indicator pin is actuated (extended), remove and clean or replace fuel filter and clean filter cavity. Refer to 11, Fuel Filter Inspection.

(3) Check indicator pin on oil filter bypass indicator valve. Refer to 7, Oil Filter Bypass Indicator Valve Inspection.

5. Peroidic Inspection Requirements

NOTE: Periodic servicing requirements, such as oil changing, are not included in this section. Refer to GENERAL - SERVICING.

A. Routine Periodic Inspection

Inspections are recommended at intervals of engine operating hours specified in Table 601. Specified inspection intervals should not be exceeded by more than 10 hours of engine operation.

Upon completion of these inspections, make engine log book entry noting engine operating time. Also, maintain inspection records with permanent engine records. (Refer to Table 602 for sample form.)

Items normally replaced during these inspections are contained in Routine Periodic Inspection Kit, Part No. 658523-1. Nomenclature, part number and quantity of each item contained in kit is provided in Table 603, with a reference to show application. The kit may be procured from any Garrett approved service center.

Table 601. Routine Periodic Inspection Requirements

Nature of Inspection	Each 150 hr	Each 300 hr
SOAP check (Refer to 9, Spectrographic Oil Analysis Program (SOAP) Check.)	X	
NOTE: SOAP has proved to be effective at other than the intervals recommended in diagnosing engine problems. Therefore, it is recommended an oil sample (with oil filter) be submitted for analysis when an intermittent or change in engine operating parameter occurs. Example: fluctuating oil pressure, change in audible noise level, etc. SOAP check interval is based on engine operating hours since any of the following maintenance activities: Oil fill at initial engine installation, last oil change, or following replacement of planet gear assembly or planet gearshaft, pinion gearshaft, or ring gear. A SOAP sample (9, Spectrographic Oil Analysis Program (SOAP) Check) is required at 25 engine operating hours following any of the specified activities to establish a baseline for subsequent checks. Refer to GENERAL - SERVICING for oil change requirement.		
Chip Detector - Remove and inspect. (Refer to 6, Chip Detector Inspection.)	X	
Accessory Drive Splines on Accessory Drive Gearbox - Check for wear. (Refer to 12, Accessory Drive Splines Inspection.)	X	
Electrical Wiring and Connections - Check for security and damage.	X	
Fan Rotor Assembly Blades - Inspect for foreign object damage. (Refer to 13, Fan Rotor Assembly Blades Inspection.)	X	

Table 601. Routine Periodic Inspection Requirements (Cont)

Nature of Inspection	Each 150 hr	Each 300 hr
(Pre SB 73-3016) Fuel Manifold Assembly - Perform cross-flow check. (Refer to Light Maintenance Manual, Chapter/Section/Subject, 72-00-00, Inspection/Check for fuel manifold assembly cross-flow check instructions.)	X	
NOTE: (Pre SB 73-3016) Engines with more than 700 total operating hours shall perform initial check within the next 50 hours of engine operation. Subsequent checks should be performed in conjunction with routine scheduled 150-hour inspections.		
Ignition System - Inspect for serviceability. (Refer to 14, Ignition System Check.)	X	
Plumbing Lines and Connections - Check for security, leaks, cracks, cuts, or rubbing.	X	
Fuel Filter Element - Inspect and clean or replace. (Refer to 11, Fuel Filter Inspection.)		X
NOTE: Remove and clean or replace fuel filter element after initial 25 hours of engine operation.		
Igniter Plugs and Igniter Lead Terminals - Remove igniter plugs and visually inspect igniter plugs and igniter lead terminals. (Refer to 15, Igniter Plugs and Igniter Lead Terminals Inspection.)		X

Table 602. Routine Periodic Inspection Record Form

AIRCRAFT SERIAL NO. _____ DATE _____
ENGINE SERIAL NO. _____ TOTAL ENGINE OPERATING HOURS _____

150 HOUR INSPECTION (Refer to Table 601)	MECHANIC	INSPECTOR
SOAP Check		
Chip Detector		
Accessory Drive Splines		
Electrical Wiring Connectors		
Fan Rotor Assembly Blades		
Fuel Manifold Cross Flow		
Ignition System		
Plumbing Lines, Connections		
300 HOUR INSPECTION (Refer to Table 601)		
Fuel Filter Element		
Igniter Plugs, Lead Terminals		

Table 603. Routine Periodic Inspection Kit Part No. 658523-1

Nomenclature	Part No.	Qty	Application Reference
Packing	S9412-032	1	IPC Figure 24, 20
Packing	S9413-012	1	IPC Figure 44, 245
Packing	S9413-036	1	IPC Figure 60, 55
Packing	S9413-557	1	IPC Figure 44, 255
Packing	S9413-015	1	IPC Figure 63, 25
Packing	S9413-016	1	IPC Figure 63, 20
Packing	S9413-212	1	IPC Figure 24, 25
Packing	S9413-236	1	IPC Figure 64, 80
Gasket	362-509-9002	2	IPC Figure 30, 75, 110

5. B. Major Inspection

Refer to Service Bulletin 72-3105 for specified intervals for major periodic inspections.

Refer to Light Maintenance Manual, Chapter/Section/Subject 72-00-00, INSPECTION/CHECK for listing of major peroidic inspection requirements.

6. Chip Detector Inspection

A. Remove Magnetic Plug (240, figure 601)

(1) Disconnect electrical connector from magnetic plug (240) in accordance with Aircraft Maintenance Manual.

(2) Hold check valve housing with wrench, use second wrench to remove magnetic plug (240). Discard packing (245).

B. Inspect Chip Detector

(1) Check magnetic plug (240) for metal particles.

(2) If metal particles are evident, perform the following procedures.

(a) Reset pin on oil filter bypass valve if extended.

(b) Remove, inspect and replace oil filter in accordance with 8, Oil Filter Inspection.

(c) Perform SOAP check, and forward oil sample and removed oil filter to approved SOAP laboratory in accordance with 9, Spectrographic Oil Analysis Program (SOAP) Check.

(d) Inspect transfer gearbox for metal particles in accordance with 10, Transfer Gearbox Inspection.

(3) If metal particles are evident on magnetic plug only (240), none in oil filter or transfer gearbox, perform the following procedures.

(a) Clean magnetic plug, and reinstall in accordance with 6.C. Install Magnetic Plug.

(b) Run engine throughout full power range in accordance with Aircraft Flight Manual for 15 minutes. (In cold weather operation, run engine more than 15 minutes if required to obtain minimum oil temperature of 4C (40F). Determine if engine is acceptable for continued operation (run did not produce recurrance of initial indication) by repeating magnetic plug, oil filter bypass indicator valve, SOAP, and transfer gearbox inspections.

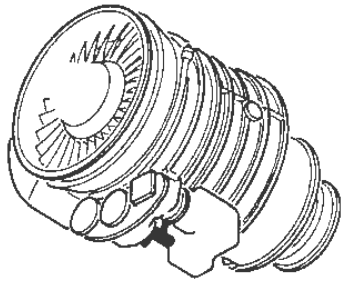
6. B. (3) (c) Upon reaching three to five hours of engine operation following engine run and checks in step 6.B.(3)(b), repeat magnetic plug, oil filter bypass indicator valve, SOAP, and transfer gearbox inspections.

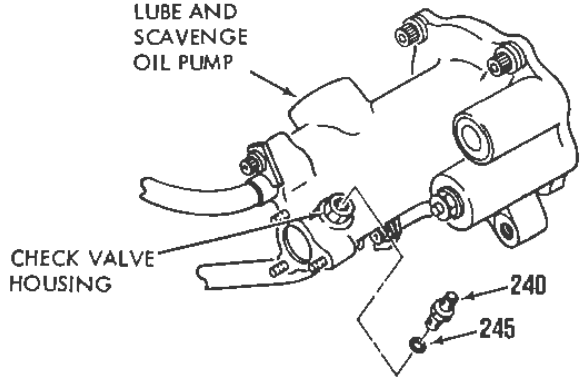
C. Install Magnetic Plug (240)

(1) Install new packing (245) on magnetic plug (240).

(2) Install magnetic plug (240) in check valve housing. Hold check valve housing with wrench, and using a second wrench, tighten magnetic plug (240) to 35 to 40 inch-pounds torque and lockwire.

(3) Connect electrical connector to magnetic plug (240) in accordance with Aircraft Maintenance Manual.





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240. MAGNETIC PLUG (IPC FIG. 44) 245. PACKING (S9413-012)

Chip Detector
Figure 601

7. Oil Filter Bypass Indicator Valve Inspection

A. Inspect Oil Filter Bypass Indicator Valve

(1) Check indicator pin on oil filter bypass valve (figure 602).

(2) If pin is extended, reset pin, and perform the following procedures.

(a) Check magnetic plug of chip detector in accordance with 6, Chip detector Inspection.

(b) Remove, inspect and replace oil filter in accordance with 8, Oil Filter Inspection.

(c) Perform SOAP check, and forward oil sample and removed oil filter to approved SOAP laboratory in accordance with 9, Spectrographic Oil Analysis Program (SOAP) Check.

(d) Inspect interior of transfer gearbox for metal particles in accordance with 10, Transfer Gearbox Inspection.

8. Oil Filter Inspection

A. Remove Oil Filter

(1) Remove filter cap (40, figure 602). Discard packing (55).

(2) Remove filter (60) from accessory drive gearbox. If same filter (60) is to be re-installed, inspect packing (70) (in place) in filter. Do not remove packing (70) from filter (60) unless damage is evident.

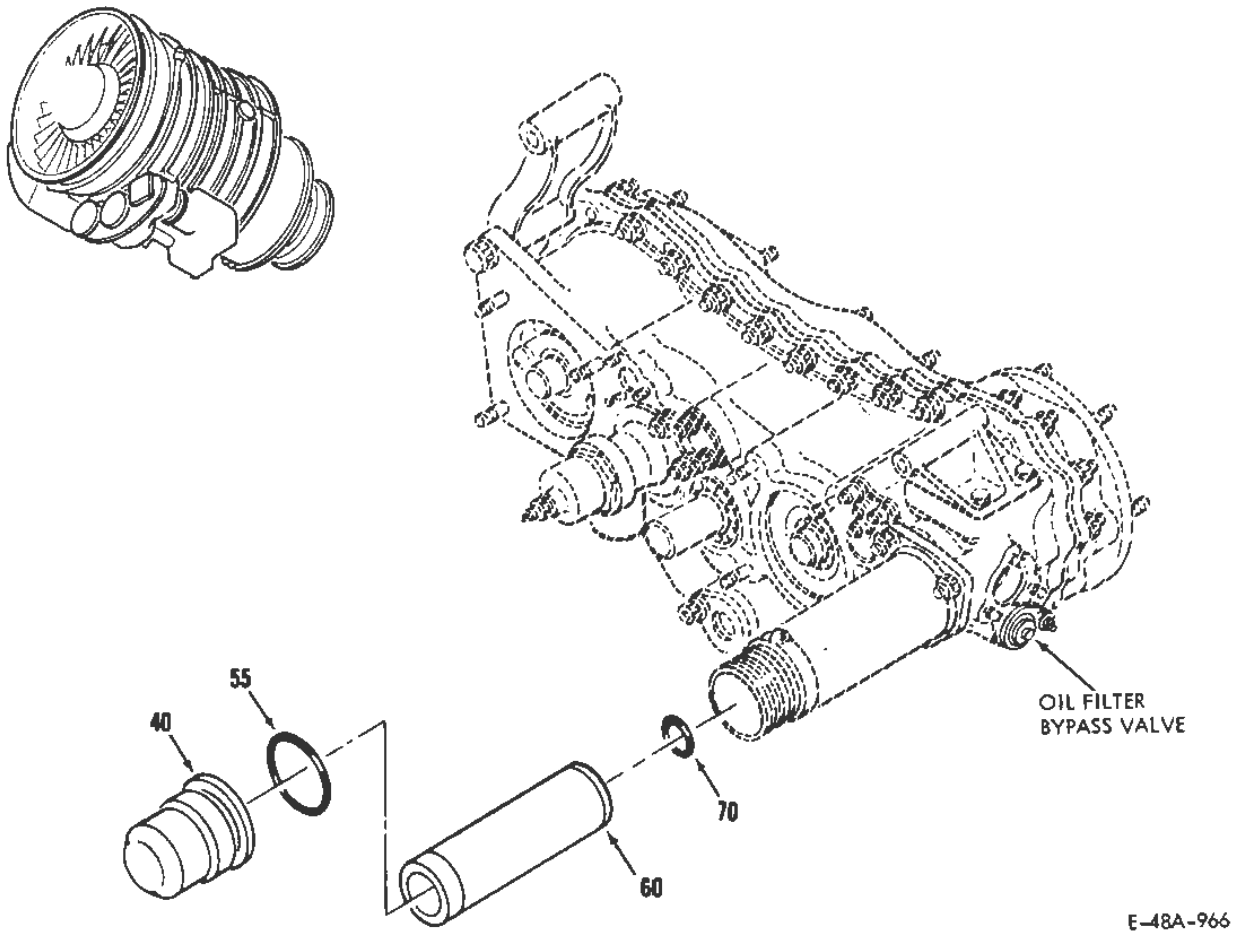
B. Inspect Oil Filter

(1) Visually inspect oil filter for contamination. If any metal chips are visible through oil filter mesh, perform the following procedures.

(a) Reset pin on oil filter bypass indicator valve if extended.

(b) Check magnetic plug of chip detector in accordance with 6, Chip Detector Inspection.

(c) Perform SOAP check, and forward oil sample and removed oil filter to approved laboratory in accordance with 9, Spectrographic Oil Analysis Program (SOAP) Check.



40. FILTER CAP (IPC FIG. 60)
55. PACKING (S9413-036)
60. FILTER
70. PACKING (S9413-214) (INCLUDED ON NEW FILTER)

Oil Filter Bypass Indicator Valve, and Oil Filter
Figure 602

8. B. (1) (d) Inspect interior of transfer gearbox for metal particles in accordance with 10, Transfer Gearbox Inspection.

(e) If metal particles are evident on oil filter and magnetic plug only, none in transfer gearbox, start preliminary investigation of source while awaiting SOAP results.

(2) Visually inspect for cracks or breaks in outer shell.

(3) Replace damaged or contaminated filter.

C. Install Oil Filter

NOTE: Packing (70, figure 602) is included as part of new filter (60).

(1) If filter (60) previously removed is to be reinstalled and packing (70) has been removed for damage, apply a light coat of engine oil and install new packing (70). If installing filter (60), with packing (70) in place, apply a light coat of engine oil to internal diameter of packing without removing packing.

(2) Install filter (60), seating if firmly on tube in accessory drive gearbox.

(3) Apply a light coat of engine oil to new packing (55) and install packing in packing groove of filter cap (40).

(4) Apply a light coat of engine lubricating oil to threads of filter cap (40) and thread cap onto oil filter cover. Hand tighten cap to shoulder of cover. Do not tighten cap with wrench. Secure cap (40) with lockwire.

9. Spectrographic Oil Analysis Program (SOAP) Check

Table 603. Equipment and Materials

Equipment or Material	Manufacturer
Sampling kit PN 294199-1	The Garrett Turbine Engine Company A Division of The Garrett Corporation P.O. Box 29003, Phoenix, AZ 85038

A. Perform SOAP Check

CAUTION: WHEN TAKING OIL SAMPLE FROM ENGINE FOR SOAP CHECK, ENSURE ALL EQUIPMENT USED IS CLEAN AND NOT CONTAMINATED TO PREVENT OBTAINING FALSE INDICATION OF OIL CONTAMINATION. ENSURE ENGINE OIL TEMPERATURE IS HOT. TAKE SAMPLE WITHIN 15 MINUTES AFTER SHUTDOWN.

NOTE: Whenever leakage of fuel into the oil system is suspected (odor of fuel detected in oil or oil level increases), perform Fuel-in-Oil Inspection in accordance with Light Maintenance Manual, Chapter/Section/Subject 72-00-00, INSPECTION/CHECK.

Materials required for performing SOAP check are contained in Sampling Kit, Part No. 294199-1. The sampling kit contains the following parts:

Plastic bottle (4-ounce)
Plastic bottle (32-ounce)
Blank data form
SOAP instruction sheet
Filter, Part No. 3070945-1
Packing, Part No. S9413-036
Polyethylene hose (syphon) (1/4 by 24 inches)
Mailing address label

(1) Remove oil tank filler plug (125 or 130, figure 301) and take an oil analysis sample into clean four-ounce plastic bottle using siphon hose. A minimum of one fluid ounce is required for sample. Reinstall oil tank filler plug (125 or 130).

(2) Identifiy SOAP sample with the following data.

(a) Date of sample.

9. A. (2) (b) Total engine run hours.

(c) Oil brand and type.

(d) Quantity oil added since last SOAP sample taken.

(e) Time (engine operating hours) since last oil change.

(f) Time (engine operating hours) since last SOAP sample taken.

(g) Time (engine operating hours) since last oil filter change.

(h) Engine model number and serial number.

(i) Aircraft number.

(3) Remove oil filter from engine. Refer to 8, Oil Filter Inspection. Return removed oil filter with sampling kit.

(4) Install replacement oil filter on engine. Refer to 8, Oil Filter Inspection.

CAUTION: ENSURE THAT CONTAINERS (SMALL CONTAINER FOR SOAP SAMPLE AND LARGE CONTAINER FOR OIL FILTER) ARE PROPERLY SEALED TO PREVENT LEAKAGE DURING SHIPMENT.

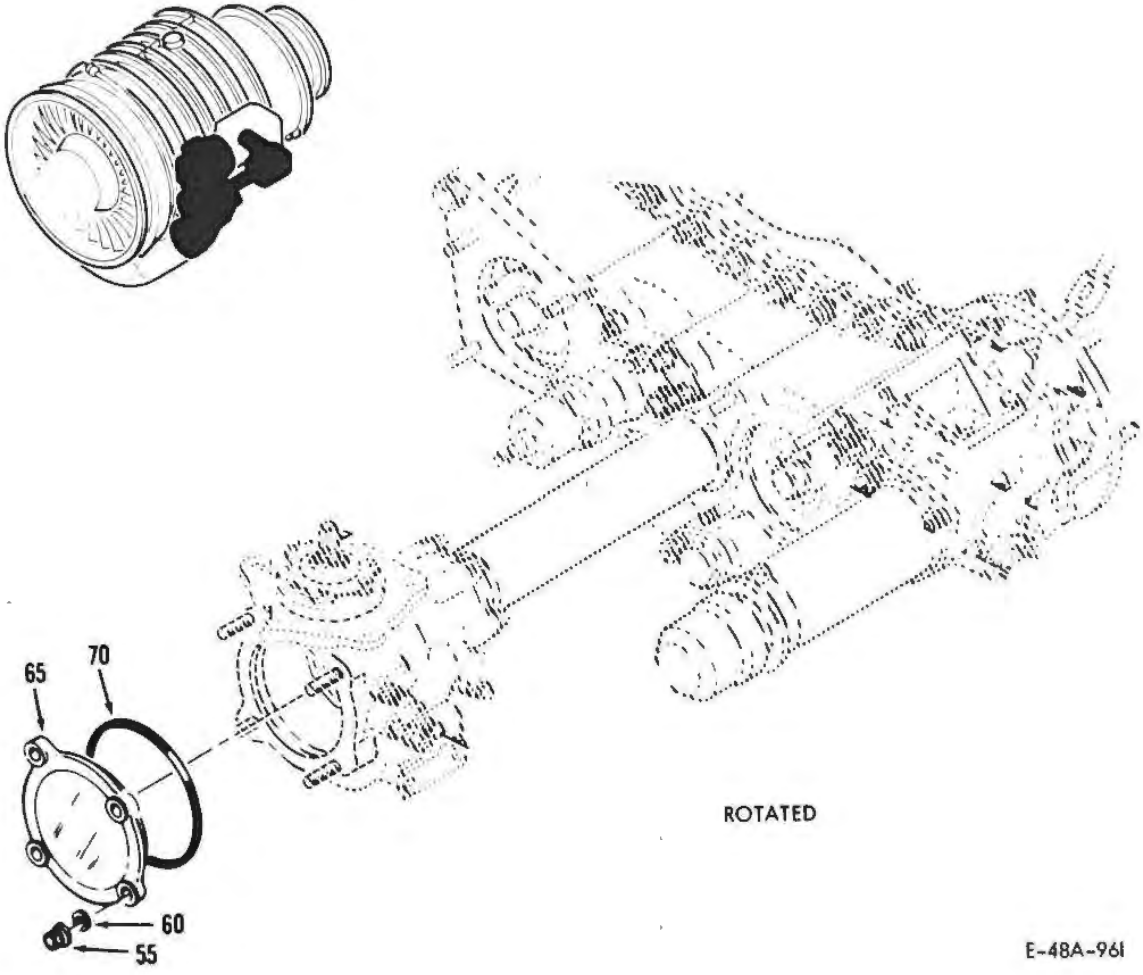
(5) Prepare sampling kit for shipment in accordance with instructions provided therein, and forward by most expeditious means to Garrett Turbine Engine Company A Division of The Garrett Corporation P.O. Box 5217, Manager Propulsion Field Service Department, Dept 77-3S, Phoenix, AZ 85010, ATTN: 628 SOAP PROGRAM or a Garrett approved laboratory. Oil samples will be examined within 24 hours after receipt of oil samples at Garrett Turbine Engine Company in Phoenix, Arizona or a Garrett approved laboratory. If high wear is indicated the user will be notified by telephone or telex within the 24-hour period after such receipt of oil sample. If examination does not indicate a high wear rate the user will be notified in writing through normal channels.

10. Transfer Gearbox Inspection

A. Remove Transfer Gearbox Cover

(1) Remove nuts (55, figure 603), washers (60) and cover (65).

(2) Remove and discard packing (70).



55. NUT (IPC FIG. 64)
60. WASHER
65. TRANSFER GEARBOX COVER
70. PACKING (S9413-236)

Transfer Gearbox Cover
Figure 603

10. B. Inspect Interior of Transfer Gearbox

(1) Check bevel gear teeth. There shall be no abnormal wear pattern, excessive wear, or chipped or broken teeth. Replace transfer gearbox if requirements are not met. Refer to Light Maintenance Manual, Chapter/Section/Subject, 72-60-03.

(2) Check interior of transfer gearbox for metal particles. If metal particles are present, check for source and repair in accordance with Light Maintenance Manual.

C. Install Transfer Gearbox Cover

(1) Install new packing (70) on cover (65).

(2) Install cover (65) and secure with washers (60) and nuts (55).

(3) Tighten nuts (55) to torque value of 30 inch-pounds.

11. Fuel Filter Inspection

Table 604. Materials and Compounds

Material or Compound	Manufacturer
NOTE: Equivalent substitutes may be used for listed item.	
Lubricating compound (Liqui-Moly, Grade NV, Thread Compound)	Lockrey Co, Lubricants Div, Cedar Shores, Southampton, NY 11968

NOTE: The following Maintenance Practices do not require the removal of the fuel pump.

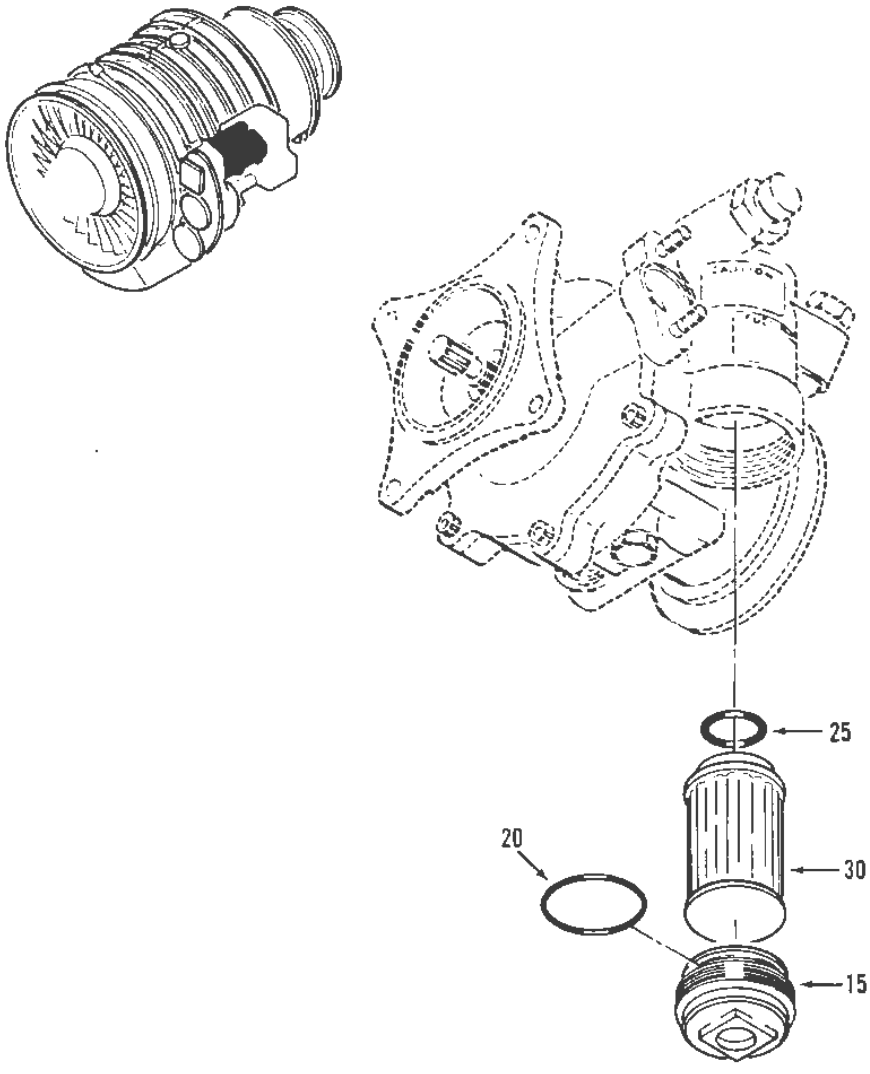
A. Remove Fuel Filter Element

(1) Using wrench on square fitting of filter bowl cover (15, figure 604), unscrew and remove filter bowl cover. Remove and discard packing (20).

(2) Remove fuel filter element (30) from filter cavity of fuel pump. Remove and discard packing (25).

B. Inspect Fuel Filter

(1) Inspect filter bowl cover (15) for stripped or damaged threads, or any obvious damage.



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15. FILTER BOWL COVER (IPC FIG. 24)
20. PACKING (S9412-032)
25. PACKING (S9413-212)
30. FUEL FILTER ELEMENT (865791-4)

Fuel Filter
Figure 604

11. B. (2) Inspect fuel filter element (30) for damage and cleanliness. Refer to Cleaning/Painting.

(3) Replace items that do not meet inspect requirements.

C. Install Fuel Filter Element (See figure 604)

(1) Install new packings (20, 25) on fuel filter element (30) and filter bowl cover (15).

(2) Install fuel filter element (30) in filter cavity of fuel pump.

(3) Coat threads of filter bowl cover (15) with light coat of lubricating compound (Liqui-Moly, Grade NV, thread compound). Install filter bowl cover (15), tighten to torque value of 40 inch-pounds and lockwire.

12. Accessory Drive Splines Inspection

Table 605. Materials and Compounds

Material or Compound	Manufacturer
NOTE: Equivalent substitutes may be used for listed items.	
Solvent (Shell 360)	Shell Oil Co, 50 W 50th St, New York, NY 10020

A. Inspect and Lubricate Accessory Drive Splines of Accessory Drive Gearbox

(1) Remove airframe-furnished accessories from drive pads on forward face of accessory drive gearbox in accordance with Aircraft Maintenance Manual.

(2) Clean splines on accessory drive gearbox and splines on removed accessory with solvent (Shell 360).

(3) Dry splines using a directed air blast of clean compressed air.

12. A. (4) Inspect splines on accessory drive gearbox for wear. Maximum allowable depth of internal spline wear, measured at pitch line of tooth, is a nominal 0.010 inch. Determine wear depth by comparing maximum wear area on spline with end where there is no wear. This "no wear" area is normally at extreme aft end of spline where there is no engagement with mating spline of accessory. If allowable wear limit is exceeded, remove and replace gearshaft as necessary in accordance with Light Maintenance Manual, Chapter/Section/Subject, 72-60-02.

(5) Lubricate splines in accordance with 8, Servicing.

(6) Install accessories on forward face of accessory drive gearbox in accordance with Aircraft Maintenance Manual.

13. Fan Rotor Assembly Blades Inspection

A. Inspect Fan Rotor Assembly Blades

NOTE: Presence of oil, dirt, salt, or other contamination on fan blades indicates need to perform compressor liquid cleaning procedure. Refer to Light Maintenance Manual, Chapter/Section/Subject 72-00-00, General - Servicing.

(1) Check fan blades for foreign object damage, erosion, nicks, cracks, or distortion which may affect balance or blade security. Rotate fan rotor assembly to check all fan rotor assembly blades.

(2) If inspection requirements of step (1) are not met, repair or replace blades of the fan rotor assembly in accordance with Light Maintenance Manual, Chapter/Section/Subject, 72-70-03.

(3) If foreign object damage is evident on any fan blades, perform borescope inspection on first-stage compressor blades in accordance with Light Maintenance Manual, Chapter/Section/Subject, 72-00-00, Inspection/Check.

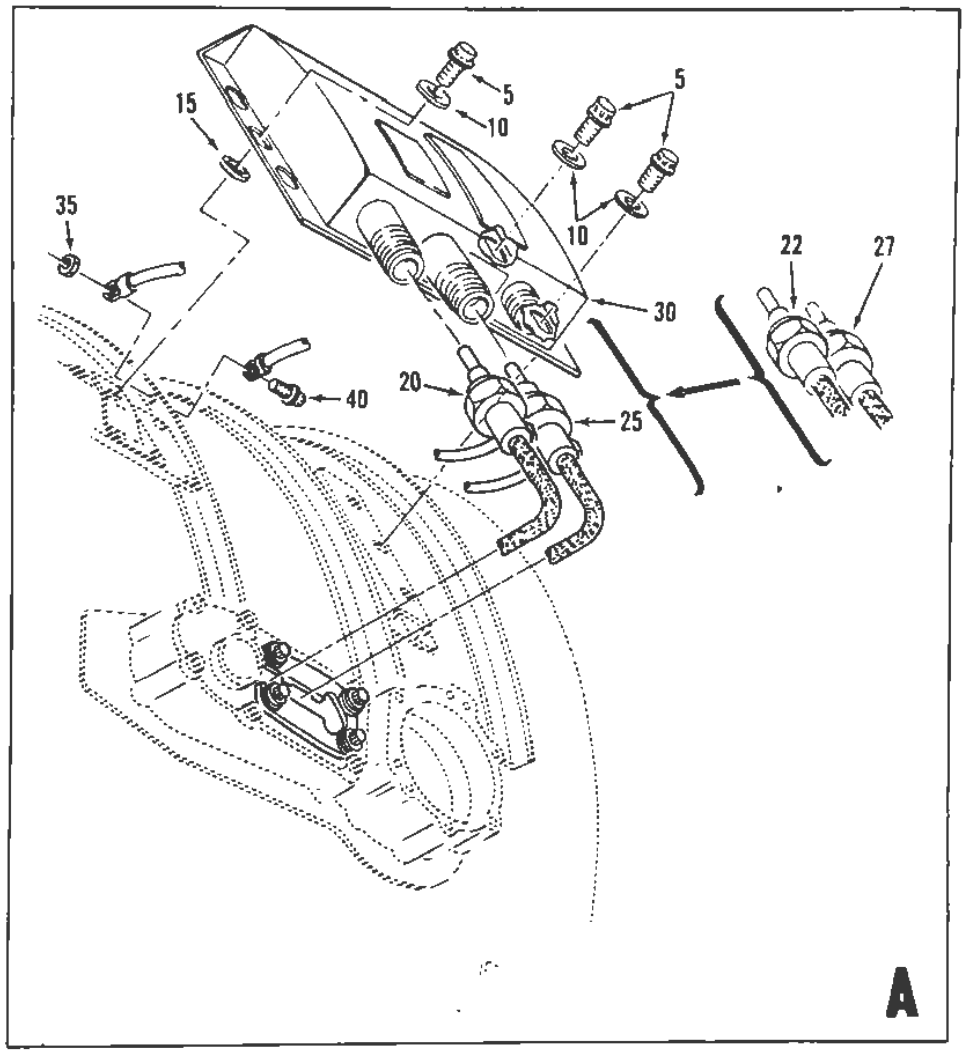
14. Ignition System Check

A. Check Ignition System Operation

(1) Shut off electrical supply to engine.

CAUTION: BENDING IGNITER LEADS WHEN DISCONNECTING FROM IGNITION UNIT WILL CAUSE DAMAGE TO INTERNAL INSULATION OF IGNITER LEADS. TO AVOID BENDING IGNITER LEADS, REMOVE IGNITION UNIT MOUNTING BOLTS BEFORE DISCONNECTING IGNITER LEADS FROM IGNITION UNIT.

(2) Remove bolts (5, figure 605) and washers (10, 15).



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5. BOLT (IPC FIG. 29)
10. WASHER
15. WASHER
20. IGNITER LEAD
22. IGNITER LEAD
25. IGNITER LEAD
27. IGNITER LEAD
30. IGNITION UNIT
35. NUT
40. BOLT

Ignition System Check
Figure 605

14. A. (3) Disconnect igniter lead (25) from connector on ignition unit (30).

(3a) When igniter leads with restraining cables are used, remove nuts (35) and bolts (40).

WARNING: ENSURE GOOD ELECTRICAL CONNECTIONS ARE MADE WHEN PERFORMING THE FOLLOWING STEPS. IF IGNITION UNIT IS NOT BOLTED TO ENGINE, OR IF FABRICATED GROUND LEAD IS NOT SECURELY CONNECTED, ELECTRICAL ARCING WILL CAUSE A FIRE HAZARD. POOR CONNECTIONS WITH FABRICATED GROUND MAY DAMAGE CONNECTOR ON IGNITION UNIT.

(4) Reinstall and tighten one mounting bolt (5) to provide good electrical ground for ignition unit (30).

(5) Short internal high voltage socket of connector (for igniter lead (25)) on ignition unit to ground. Ground connection may be accomplished by fabricating a ground lead terminated with a 10-40560 terminal (The Bendix Corp, Electrical Components Division, Sherman Avenue, Sidney, NY 13838) for connection to ignition unit. Terminal contained in 3070873-1 igniter lead parts kit may be used in lieu of 10-40560 terminal.

(6) Perform an engine start in accordance with Aircraft Flight Manual. If unable to start engine, igniter plug at 6 o.clock position on plenum case is not firing properly. Test and Troubleshoot ignition system, and replace defective parts as required in accordance with Light Maintenance Manual, Chapter/Section/Subject 74-00-01.

(7) Shut down engine, and shut off electrical supply to engine.

(8) Remove bolt (5), and disconnect ground lead, connected in step (5), from ignition unit (30).

(9) Reconnect igniter lead (25) to ignition unit (30), and tighten connector of igniter lead (25) finger tight.

(10) Disconnect igniter lead (20) from connector on ignition unit. Short internal high voltage socket of connector (for igniter lead (20)) on ignition unit (30) to ground with ground lead fabricated in step (5).

(11) Reinstall and tighten one bolt (5) for ignition unit to provide good electrical ground for ignition unit.

(12) Tighten igniter lead (25) to torque of 150 inch-pounds.

14. A. (13) Perform an engine start in accordance with Aircraft Flight Manual. If unable to start engine, igniter plug at 7 o'clock position on plenum case is not firing properly. Test and troubleshoot ignition system, and replace defective parts as required in accordance with Light Maintenance Manual, Chapter/Section/Subject 74-00-01, MAINTENANCE PRACTICES.

(14) Shut down engine, and shut off electrical supply to engine.

(15) Remove bolt (5), and disconnect ground lead, connected in step (10), from ignition unit (30).

CAUTION: BENDING IGNITER LEADS WHEN CONNECTING TO IGNITION UNIT WILL CAUSE DAMAGE TO INTERNAL INSULATION OF IGNITER LEADS. DO NOT MOUNT IGNITION UNIT ON ENGINE BEFORE CONNECTING IGNITER LEADS TO IGNITION UNIT.

(16) Reconnect igniter lead (20) to connector on ignition unit (30). Tighten connector of igniter lead (20) finger tight.

(17) Loosen connector of igniter lead (25) at connector on ignition unit until just finger tight.

(18) Position ignition unit (30) on engine. If necessary for ignition unit to clear fan duct set, install washers (15) (maximum of one at each mounting boss) between mounting bosses and ignition unit.

(19) Install washers (10) and bolts (5) and tighten to torque of 50 inch-pounds and lockwire.

(20) Tighten igniter leads (20, 25) at ignition unit to torque of 150 inch-pounds and lockwire.

• (21) When igniter leads with restraining cables are used, secure terminals on restraining cables to fan duct set with nut (35) and bolt (40).

15. Igniter Plugs and Igniter Lead Terminals Inspection

Table 606. Materials and Compounds

Material or Compound	Manufacturer
NOTE: Equivalent substitutes may be used for listed item.	
High temperature compound (Fel-Pro C-5A)	Fel-Pro Inc, Div of Felt Products Mfg Co, 7450 N McCormick Blvd, Skokie, IL 60076

15. A. Remove Igniter Plugs

(1) Shut off electrical supply to engine.

(2) Remove door (35, figure 606) from bottom panel.

(3) Remove bolts (65, 110, 120, figure 607), and remove igniter plugs (70, 125) and gaskets (75, 130).

(4) Disconnect igniter lead terminals from igniter plugs (70, 125).

B. Inspect Igniter Plugs

NOTE: An internal rattle may be evident when igniter plug is shaken. This is normal and is not cause for rejecting igniter plug.

(1) Visually inspect igniter plug for broken or missing parts. If igniter plug is broken or parts missing, replace plug.

(2) Visually inspect center electrode and outer shell for erosion. If electrode is eroded 0.030 inch or more below end of ceramic insulator as shown in Figure 608, replace plug. Uniform erosion on electrode and outer shell is acceptable. Erosion of outer shell in spark gap area shall not exceed 0.330 inch diameter at insulator surface.

(3) Visually inspect ceramic insulator for cracks or chipped area as shown in Figure 608. Ensure normal ceramic insulator erosion is not misinterpreted as cracking. Replace igniter plug if ceramic insulator is damaged.

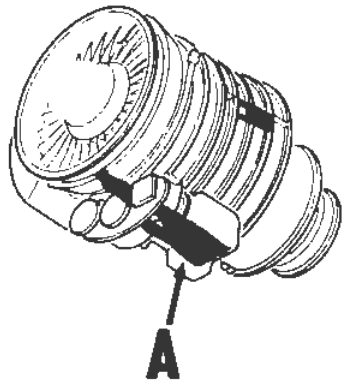
(4) Visually inspect outer shell for burned or flowed metal as shown in Figure 608. Replace plug if metal is burned or flowed.

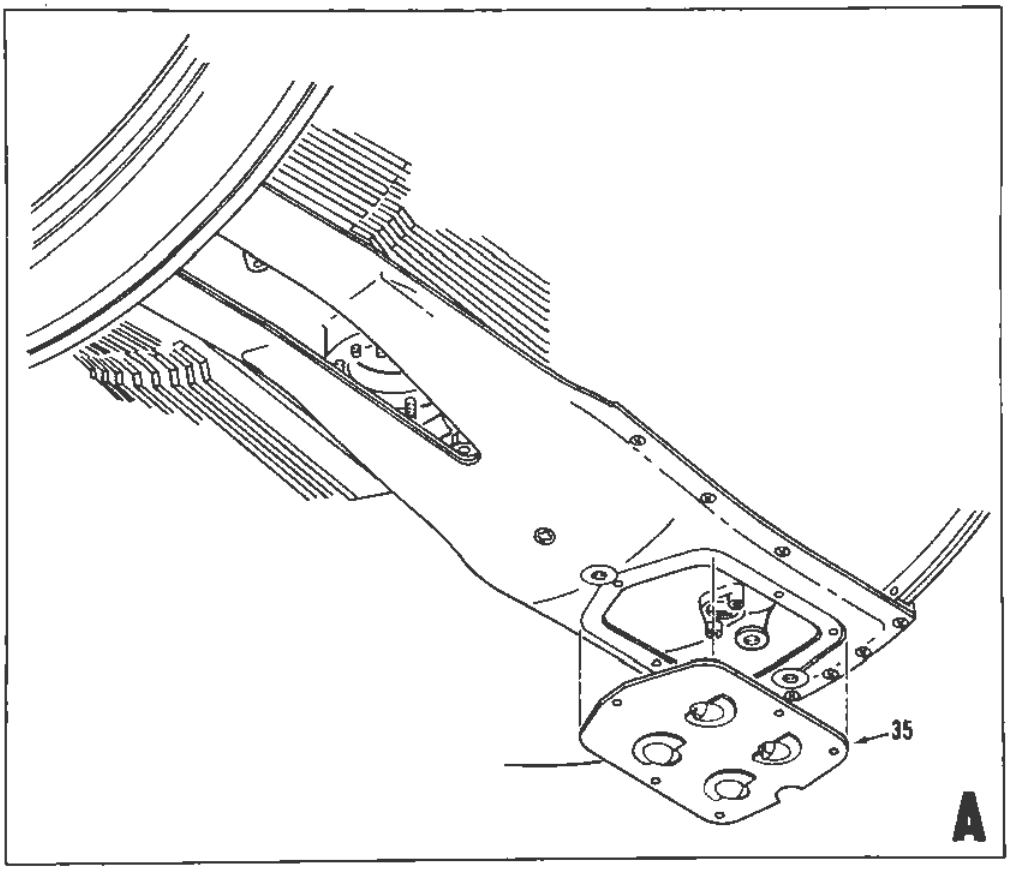
(5) Visually inspect grommet mating flange of igniter plug for grooving. If grooved on one side 0.030 inch deep or more, replace plug.

(6) Visually inspect for clogged annular passage between insulator and outer shell. If clogged, clean by abrasive blasting in accordance with Light Maintenance Manual, Chapter/Section/Subject, 72-00-00, GENERAL - CLEANING/PAINTING, or replace plug.

(7) Visually inspect for cracked or broken ceramic and bent, burned, or broken or loose pin in the igniter plug connector. Replace damaged plug.

(8) Visually inspect for cracked flanges. If cracked, replace plug.





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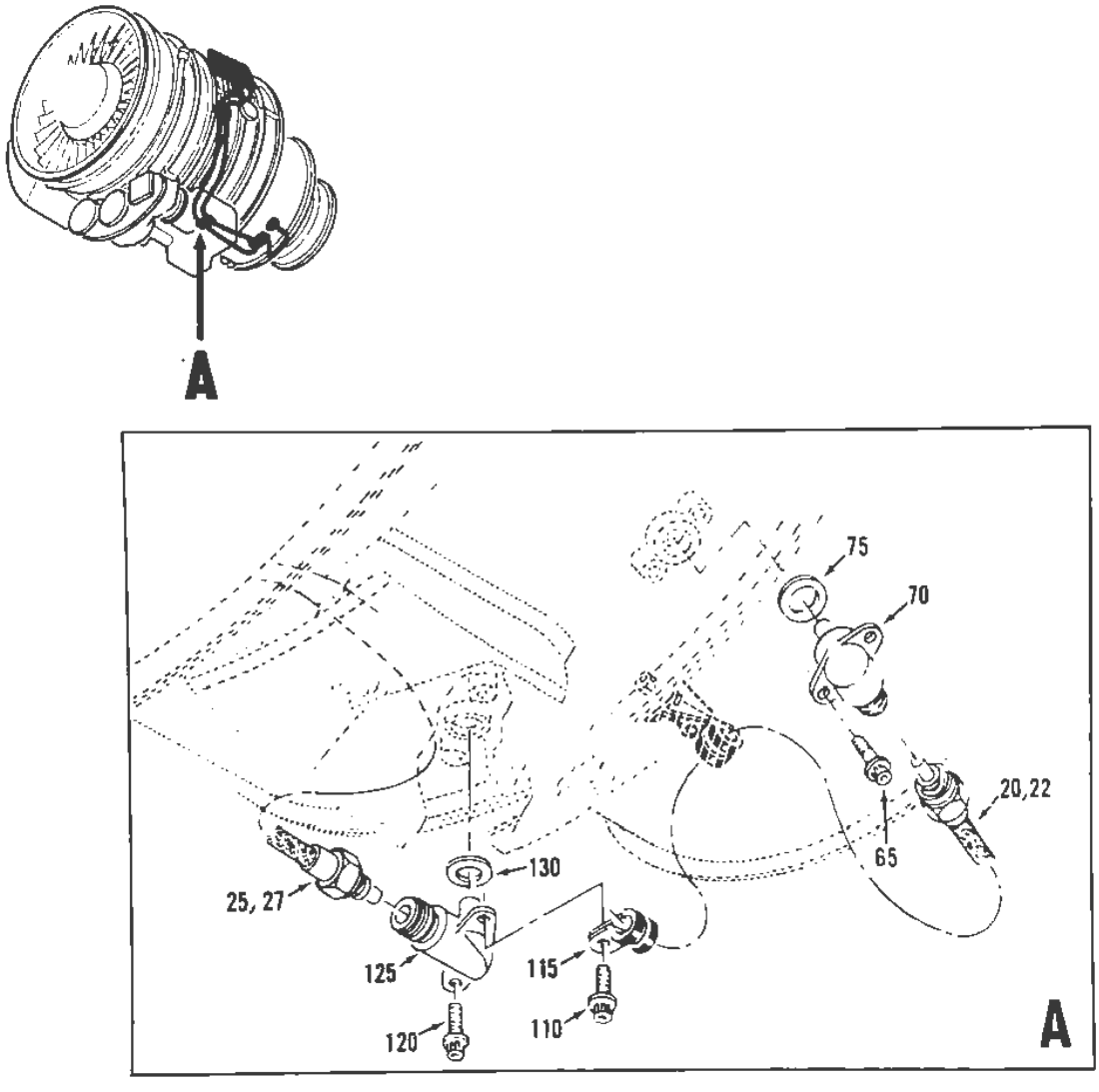
35. DOOR (IPC FIG. 11)

Bottom Panel Door Removal/Installation
Figure 606



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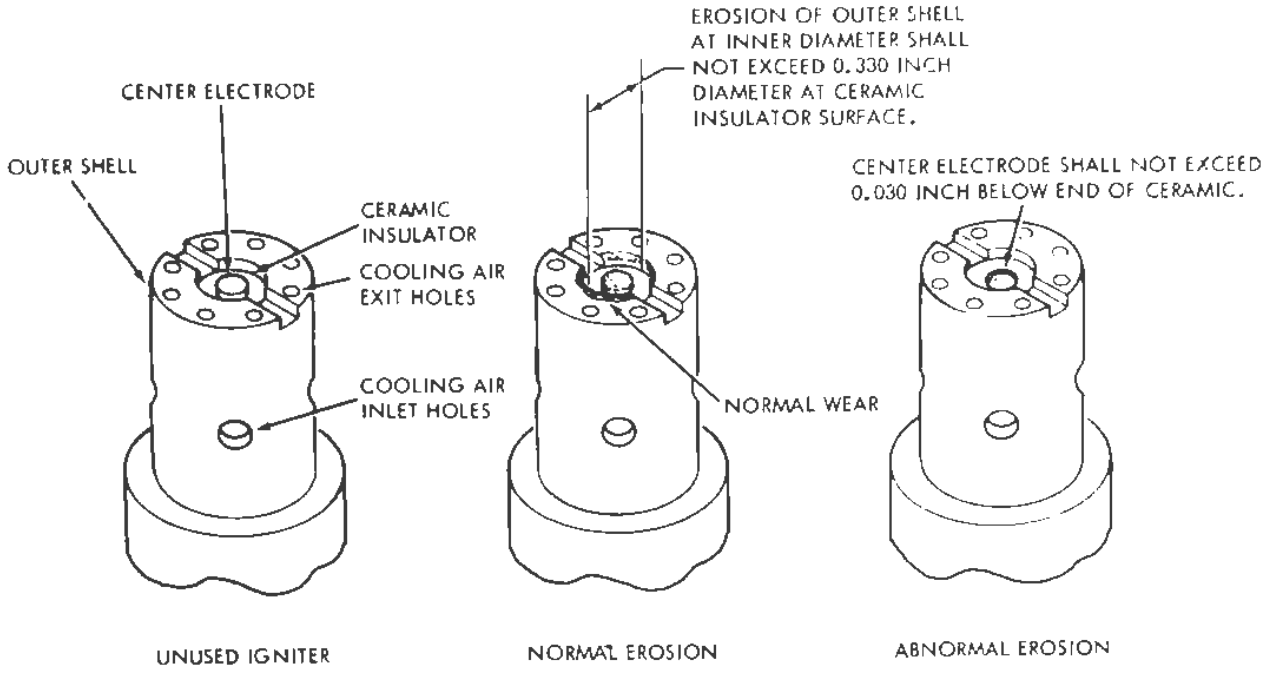
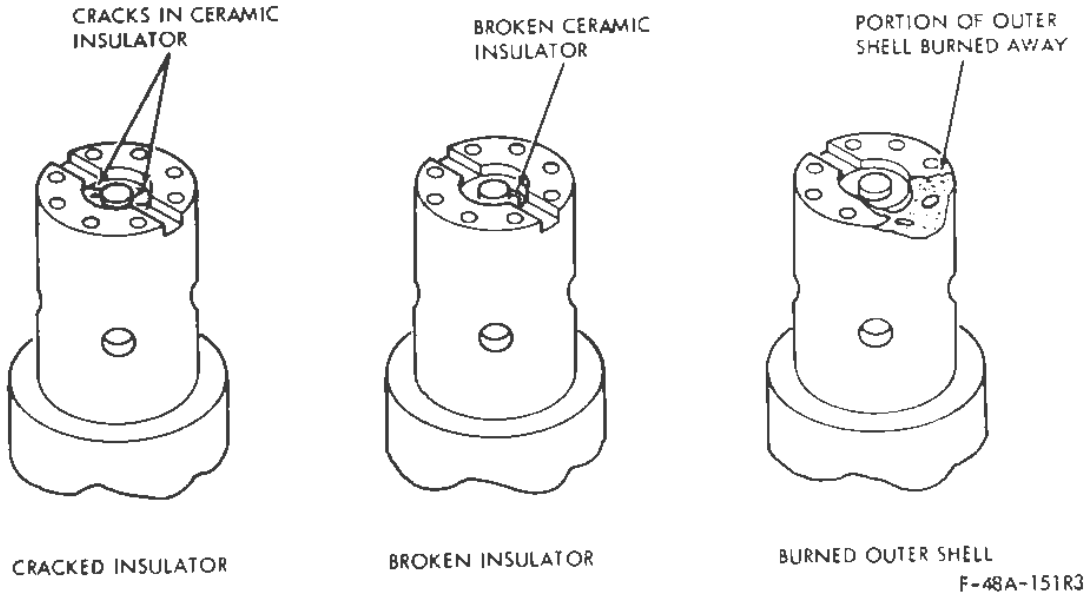
20. IGNITER LEAD (IPC FIG. 30)
22. IGNITER LEAD
25. IGNITER LEAD
27. IGNITER LEAD
65. BOLT
70. IGNITER PLUG
75. GASKET (362-509-9002)
110. BOLT
115. CLAMP
120. BOLT
125. IGNITER PLUG
130. GASKET (362-509-9002)

Ingiter Plugs
Figure 607


CENTER ELECTRODE
OUTER SHELL
CERAMIC INSULATOR
COOLING AIR EXIT HOLES
COOLING AIR INLET HOLES
EROSION OF OUTER SHELL AT INNER DIAMETER SHALL NOT EXCEED 0.330 INCH DIAMETER AT CERAMIC INSULATOR SURFACE.
NORMAL WEAR
CENTER ELECTRODE SHALL NOT EXCEED 0.030 INCH BELOW END OF CERAMIC.
UNUSED IGNITER
NORMAL EROSION
ABNORMAL EROSION



Igniter Plug Inspection
Figure 608

15. C. Inspect Igniter Lead Terminals

NOTE: Overheating of igniter lead terminals may be caused by hot gas leakage, either around igniter plug gasket or through igniter plug insulator. If evidence of overheating or arcing exists, replace igniter plug and gasket associated with damaged igniter lead and repair or replace damaged igniter lead.

(1) Inspect igniter lead terminals for deformation, cracks, chipping, or evidence of arcing. No damage is allowed.

(2) Replace or repair igniter lead or lead terminals if inspection requirements are not met. Refer to Light Maintenance Manual, Chapter/Section/Subject, 74-00-01 for approved repairs.

D. Installation of Igniter Plugs

CAUTION: BOLTS SECURING IGNITER PLUGS SHALL BE TIGHTENED ALTERNATELY IN TEN INCH-POUND INCREMENTS UNTIL FINAL TORQUE OF 50 INCH-POUNDS IS OBTAINED TO PULL IGNITER PLUG IN PLACE EVENLY WITHOUT COCKING. A GAP MAY EXIST UNDER IGNITER PLUG FLANGE AFTER TIGHTENING BOLTS. DO NOT TIGHTEN BOLTS TO TORQUE OF MORE THAN 50 INCH-POUNDS AS IGNITER PLUG MOUNTING FLANGES MAY BE CRACKED.

(1) Install one new gasket on each igniter plug. Install clamp on longer igniter lead at position for bolt (110, figure 607). Coat threads of bolts (65, 110, 120) with high temperature compound (Fel-Pro C5-A). Secure igniter plugs to engine with attaching bolts (65, 110, 120). Alternately tighten bolts (65, 110, 120) in ten inch-pound increments to torque of 50 inch-pounds, then lockwire bolts.

(2) Install igniter leads on igniter plugs. Tighten connectors of igniter leads at igniter plugs to torque of 150 inch-pounds.

(3) Install door (35, figure 606) to bottom panel.

CHAPTER 72 - GENERAL - CLEANING/PAINTING

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GENERAL - CLEANING/PAINTING

1. General

   A. The cleaning procedures detailed in this section are those that are required to perform the inspection/check procedures outlined with this publication.

   B. Table 701 provides a list of all materials and compounds required to Perform GENERAL - CLEANING/PAINTING.

Table 701. Materials and Compounds

Material or Compound	Manufacturer
NOTE: Equivalent substitutes may be used for listed items.	
Blackstone ultrasonic cleaner (SP-103)	J.E. Phillips Co, Inc, P.O. Box 192, 10608 Culver Blvd, Culver City, CA 90230
Cleaner (Dowclene)	Dow Corning Corp, S Saginaw Rd, Midland, MI 48640
Electrocleaner (Wyandotte FS)	Wyandotte Chemicals Corp, Wyandotte, MI 48192
Muriatic acid (35 percent HCL, Commercial Grade)	Commercially available
Rust stripper (Oakite Rust Stripper)	Oakite Products Inc, 50 Valley Rd, Berkeley Heights, NJ 07922
Solvent (Shell 360)	Shell Oil Co, 50 W 50th St, New York NY 10020
Solvent, Stoddard (Federal Specification P-D-680, Type I)	Commercially available

2. Periodic Cleaning Procedures

A. Clean Standard Metallic Hardware

Clean all standard hardware with solvent, Stoddard (Federal Specification P-D-680, Type I), then dry with low pressure compressed air.

WARNING: CLEANING SHALL BE PERFORMED IN A CLEAN, WELL-VENTILATED ROOM. RUBBER GLOVES AND PROTECTIVE CLOTHING SHALL BE WORN. EXTINGUISHERS AND VAT OR TANK COVERS SHALL BE ON HAND IN CASE OF FIRE.

3. Fuel Filter Element Cleaning

NOTE: Filter element of fuel pump may be cleaned by dipping in solvent (Shell 360) and dried with filtered compressed air. However, the sonic cleaning method should be employed for a thorough cleaning. If sonic cleaning equipment is not available, use alternate method described below.

A. Clean Fuel Filter Element By Sonic Method

NOTE Beaker is used to conserve cleaner (Dowclene). Use tap water as transmitting fluid in sonic cleaner (SP-103).

(1) Place filter element in beaker of cleaner (Dowclene). Orient filter element so open end is up. Level of cleaner in beaker shall be below open end of filter. Place beaker in sonic cleaner.

(2) Operate sonic cleaner with filter element for five (5) minutes. Cleaner will become dirty.

(3) Discard dirty cleaner and rinse filter element and beaker with new cleaner using plastic squeeze bottle.

(4) Refill beaker with new cleaner and operate sonic cleaner for five (5) additional minutes.

(5) Repeat steps (3) and (4) until cleaner remains clean after a five (5) minute operation period.

(6) Remove filter element and blow dry using clean air supply.

(7) Although there may be no apparent damage to packing installed in neck of filter element, replace packing after completion of sonic cleaning.

2. B. Clean Fuel Filter Element Using Alternate Method

(1) Remove packing and thoroughly degrease fuel filter element in cold solvent, Stoddard (Federal Specification P-D-680, Type I).

(2) Prepare a solution of rust stripper (Oakite Rust Stripper) by combining three to five pounds of rust stripper to each gallon of water. Maintain prepared solution at 72 to 82C (162 to 180F). Employ air agitation to keep solution in suspension.

(3) Soak fuel filter element in rust stripper (Oakite Rust Stripper) solution for 30 minutes.

(4) Remove fuel filter element from solution and rinse thoroughly with clean water.

(5) Prepare solution of electrocleaner (Wyandotte FS) by combining nine ounces of electrocleaner to each gallon of water. Maintain solution at 22 to 34C (72 to 93F). Immerse fuel filter element in electrocleaner solution for four to six minutes. During this period fuel filter element shall be made an anode for one to two minutes at a potential of four to seven volts dc. Rinse fuel filter element in cold running tap water.

(6) Immerse fuel filter element in equal parts muriatic acid (35 percent HCL) and water, by volume, at room temperature for one-half to one minute. Rinse fuel filter element thoroughly in cold running tap water.

(7) Immerse fuel filter element in electrocleaner solution prepared in step (5) maintained at temperature of 22 to 34C (72 to 93F) for four to six minutes. Rinse in cold running tap water.

(8) Rinse fuel filter element in clean hot water. Dry fuel filter element with filtered compressed air. If cleaned fuel filter element is not to be installed immediately, place in clean container.

CHAPTER 72 - APPROVED REPAIRS

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GENERAL - APPROVED REPAIRS

1. General

Approved repair procedures resulting from unscheduled inspections or malfunctioning components are not provided in this publication. Refer to Maintenance Manual, Report No. 72-02-02.

CHAPTER 72 - MICROFICHE

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GENERAL - MICROFICHE

1. General

A. Garrett technical publications are now being furnished in microfiche form. As with most changes, this change will require some adjustments by the users of the publications. The many advantages of microfiche will outweigh inconveniences encountered during the initial transition from the printed publication to the microfiche form. Although a few problems are expected for those inexperienced with microfiche, acceptance of the microfiche form is important to its successful use. A few points are emphasized in the following paragraphs which should smooth the initial transition to the use of Garrett microfiche publications.

2. Revision Service

A. Microfiche will vastly reduce the time required to maintain the technical library. The time consuming task of inserting new revision pages into a printed publication is not required with microfiche, since each revision to a microfiche publication is complete within itself - the entire publication is refilmed. Whenever a revision to a publication is received, all of the old microfiche sheets of the publication are replaced.

3. Equipment

A. A microfiche reader or reader/printer is required in the use of microfiche publications. To obtain a single full size page from a microfiche sheet, a microfiche printer is required. For users not already using microfiche publications, this requires a new piece of equipment.

B. Readers and Reader/Printers. All Garrett microfiche is produced at a 24:1 ratio of reduction. This requires that a lens with a corresponding 24:1 ratio be used in the reader and reader/printer. The number and variety of readers and reader/printers available throughout the industry is quite large. Most are either equipped with a 24:1 lens or may have on installed. Power requirements, methods of holding the microfiche sheet, projection technique, and any special controls available vary substantially from model to model. The proper reduction ratio (24:1) lens, however, is necessary for use with Garrett microfiche.

C. Filing and Storing Systems. Many different products are marked for the filing and storing of microfiche. Inexpensive holder panels are available which can be kept in a three-ring binder. Each side of a panel provides several filing slots. When a single microfiche sheet is filed in each slot, the title blocks of all sheets are visible to provide easy handling, indexing, and access.

4. How to Use Garrett Microfiche (See figure 1)

A. The Microfiche Sheet. Each microfiche sheet carries a title block at the top of the sheet for identification, and 98 frames (seven rows of 14 frames each). The 98 frames are filmed pages of the publication. At the beginning of primary sections, "eyeball" indicators are provided to subdivide the contents of the publication.

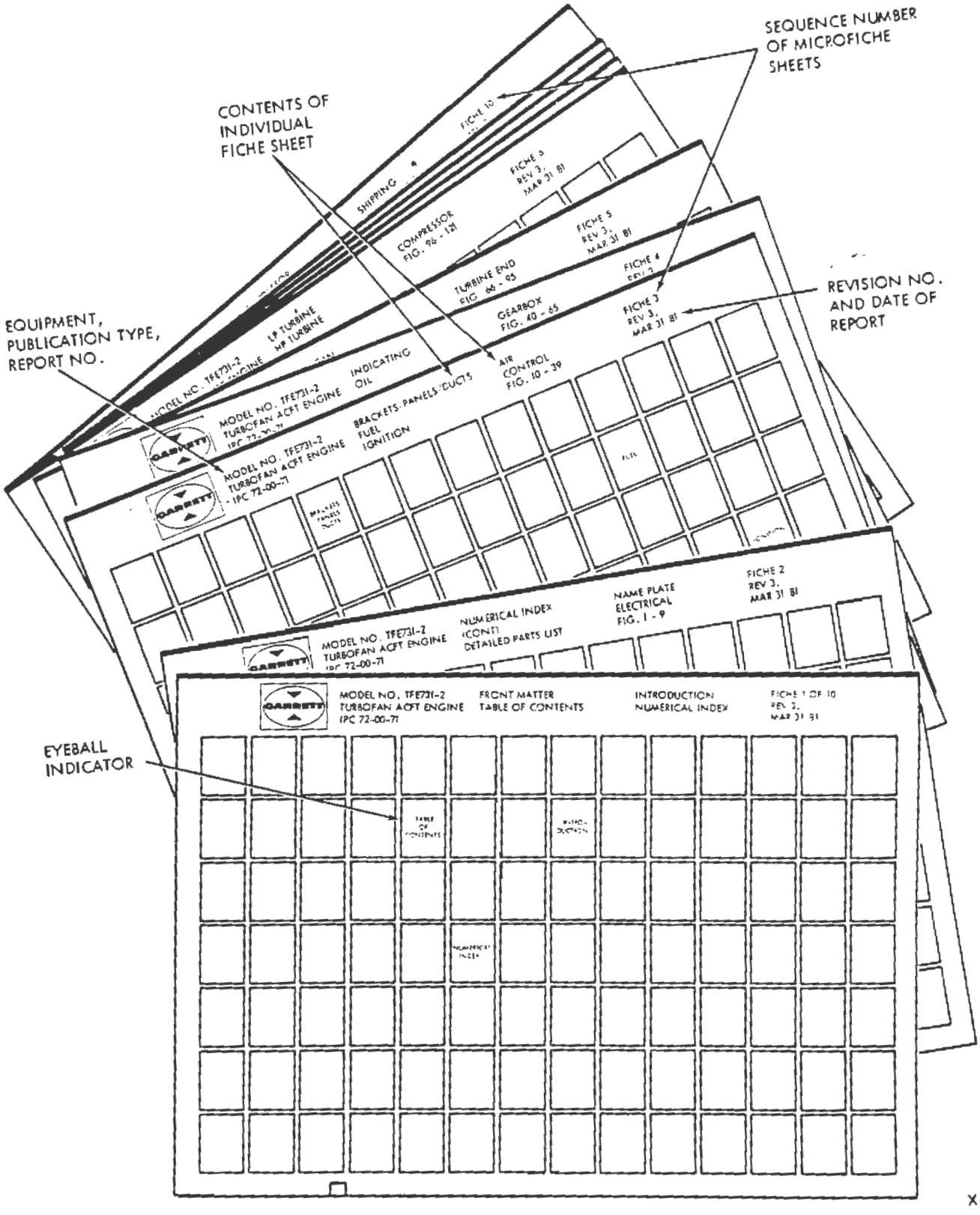
B. Microfiche Title Block. The title block at the top of each microfiche sheet identifies the equipment covered by the publication, the publication type (illustrated parts catalog, maintenance manual, etc.), the report number of the publication, the contents of the individual microfiche sheet, the revision number and date of the publication, and a sequence number for the microfiche sheet in the package (FICHE NO. XXX). Each sheet has an individual sequence number. The first sheet of the microfiche publication carries a terminal sheet number to notify the user of the total number of microfiche sheets in the package (FICHE NO. 1 OF 10, for example).

C. Microfiche "Eyeball" Indicators. Special titles are filmed within the microfiche sheet to subdivide the contents of the publication. Each title frame occupies the space for a printed page and carries a title large enough to be read without the aid of a microfiche reader. The title frames are referred to as "eyeball" indicators because only the user's unaided eye is required to read the frame. The microfiche sheets include eyeball indicators at the same locations as plastic tabs are included in the printed publications to identify the start of primary secitons. A table of contents is included at the beginning of each primary section of the publication to specify the detailed contents of the section. When a section of the publication starts on one microfiche sheet and carries over to a subsequent sheet, an eyeball indicator is used on the first frame of the subsequent sheet to indicate a continuation.

5. Microfiche Included with Service Manual

A. Microfiche is provided on the Illustrated Parts Catalog and Light Maintenance Manual for your information and convenience. (See envelopes at end of manual).

B. Hard copies of the Illustrated Parts Catalog and/or the Light Maintenance Manual will be provided at a nominal charge upon request. These publications may be obtained by contacting Garrett Turbine Engine Company A Division of The Garrett Corporation, P.O. Box 29003, Phoenix, AZ 85038, Attn: Technical Data Destribution, Dept 77-7-601, (602) 267-4807.



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Typical Garrett Microfiche Publication
Figure 901